SURVEY PRO

for Windows® CE

Reference Manual

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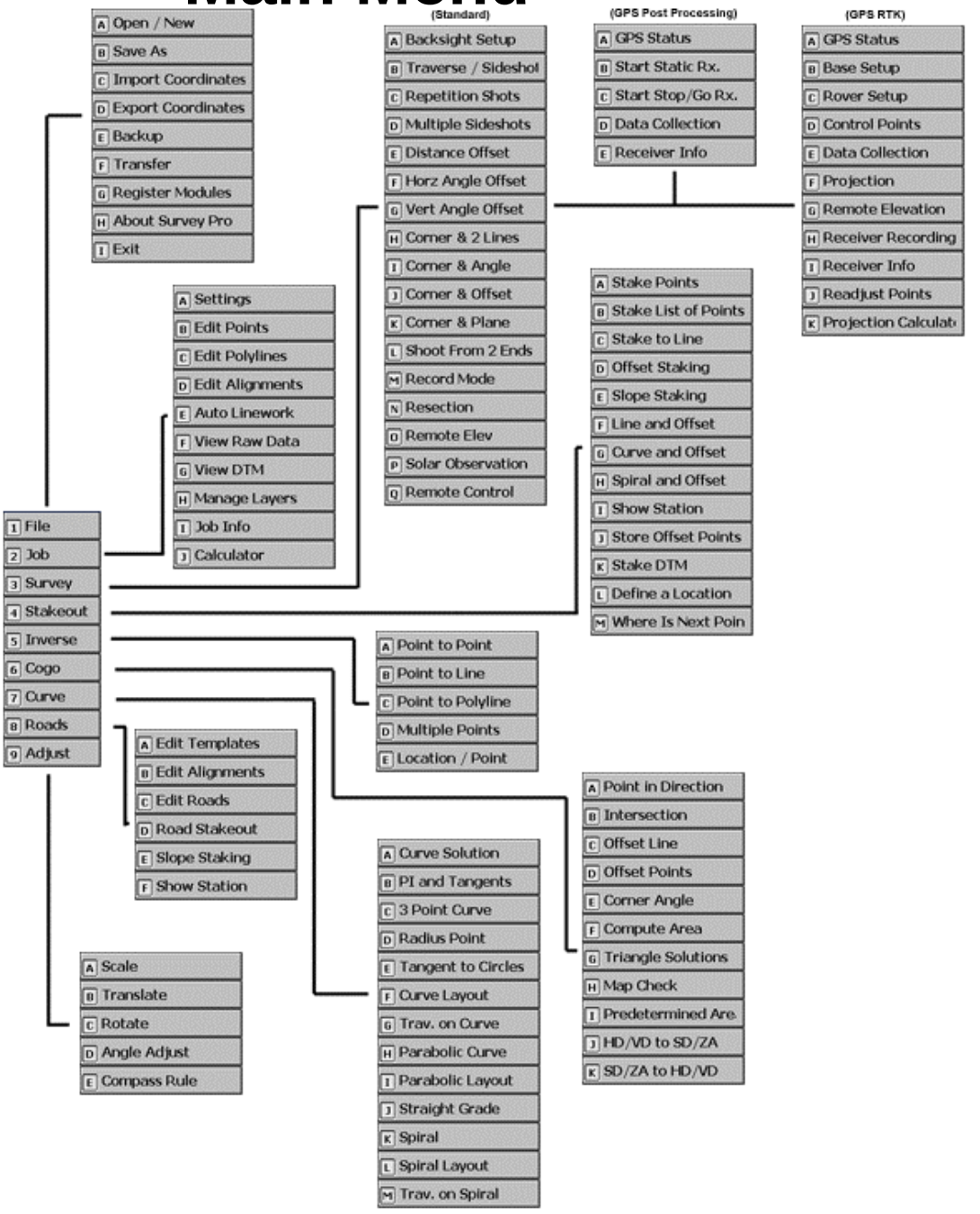
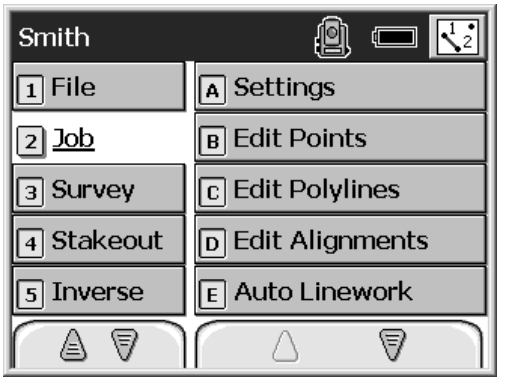
Main Menu


A Open / New
B Save As
C Import Coordinates
D Export Coordinates
E Backup
F Transfer
G Register Modules
H About Survey Pro
I Exit
(Standard)
A Backsight Setup
B Traverse / Sideshot
C Repetition Shots
D Multiple Sideshots
E Distance Offset
F Horz Angle Offset
G Vert Angle Offset
H Corner & 2 Lines
I Corner & Angle
J Corner & Offset
K Corner & Plane
L Shoot From 2 Ends
M Record Mode
N Resection
O Remote Elev
P Solar Observation
Q Remote Control
(GPS Post Processing)
A GPS Status
B Start Static Rx.
C Start Stop/Go Rx.
D Data Collection
E Receiver Info
(GPS RTK)
A GPS Status
B Base Setup
C Rover Setup
D Control Points
E Data Collection
F Projection
G Remote Elevation
H Receiver Recording
I Receiver Info
J Readjust Points
K Projection Calculat
A Settings
B Edit Points
C Edit Polylines
D Edit Alignments
E Auto Linework
F View Raw Data
G View DTM
H Manage Layers
I Job Info
J Calculator
A Stake Points
B Stake List of Points
C Stake to Line
D Offset Staking
E Slope Staking
F Line and Offset
G Curve and Offset
H Spiral and Offset
I Show Station
J Store Offset Points
K Stake DTM
L Define a Location
M Where Is Next Poin
1 File
2 Job
3 Survey
4 Stakeout
5 Inverse
6 Cogo
7 Curve
8 Roads
9 Adjust
A Point to Point
B Point to Line
C Point to Polyline
D Multiple Points
E Location / Point
A Edit Templates
B Edit Alignments
C Edit Roads
D Road Stakeout
E Slope Staking
F Show Station
A Point in Direction
B Intersection
C Offset Line
D Offset Points
E Corner Angle
F Compute Area
G Triangle Solutions
H Map Check
I Predetermined Are
J HD/VD to SD/ZA
K SD/ZA to HD/VD
A Curve Solution
B PI and Tangents
C 3 Point Curve
D Radius Point
E Tangent to Circles
F Curve Layout
G Trav. on Curve
H Parabolic Curve
I Parabolic Layout
J Straight Grade
K Spiral
L Spiral Layout
M Trav. on Spiral
A Scale
B Translate
C Rotate
D Angle Adjust
E Compass Rule

The Main Menu is the starting point where all the other screens described in this manual are accessed.

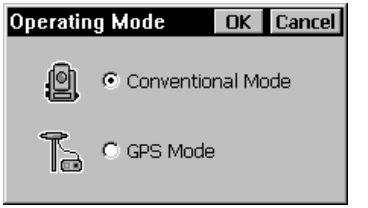


Other than accessing various screens, the following controls in the Main Menu let you change your data collection mode and view a map of the current job.

Operating Mode

The or button at the top of the screen will open a dialog box that allows Survey Pro CE with GPS users to select between surveying in Conventional Mode or GPS Mode.

When Conventional Mode is selected, the icon is displayed and when GPS Mode is selected, the icon is displayed.



For more information on surveying in GPS mode, refer to the separate Survey Pro CE GPS Manual.

Note: To order the GPS module, please contact TDS or your dealer.

Battery Level

The battery icon indicates the condition of the data collector's rechargeable battery. The icon has five variations depending on the level of charge that is remaining: 100%, 75% 50%, 25% and LOW 5%.

Note: Tapping the battery icon is a shortcut to the Microsoft Power Properties screen, which is normally accessed from the Windows CE Control Panel. Tap the ? button in the title bar of this screen to view the online help.

Map View

A map view of the current job can be displayed by tapping the  button. This screen is described on Page R-234.

File Menu

The File Menu contains routines to transfer files between the data collector and another device.

A: Open / New

B: Save As

C: Import Coordinates

D: Export Coordinates

E: Backup / Restore Job

F: Transfer

G: Register Modules

H: About Survey Pro

I: Exit

Open / New

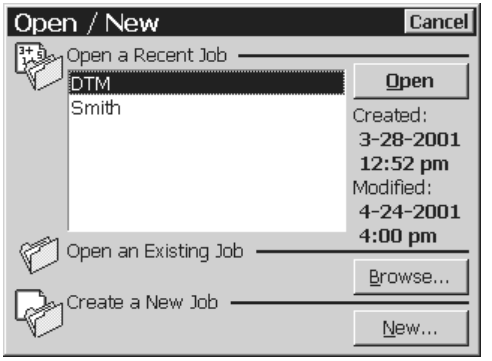
1 File | A Open / New

The Open / New screen is used to open an existing job or create a new one. This screen also appears when Survey Pro for Windows CE is first started.

Open: opens the job selected in the Open a Recent Job list.

Browse...: will open the Open screen (Page R-10) where an existing job to open can be selected.

New...: will open the New screen (Page R-7) where a new job can be created.

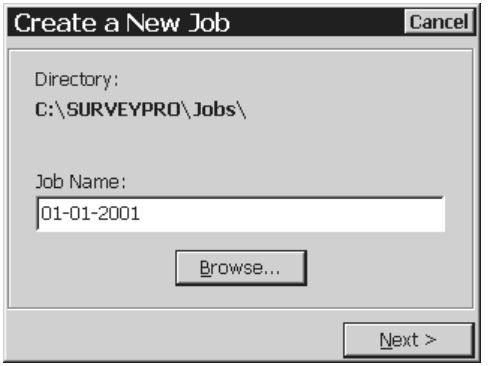


New Job

1 File | A Open / New | New...

The New Job screen is used to create a new project.

Create a New Job



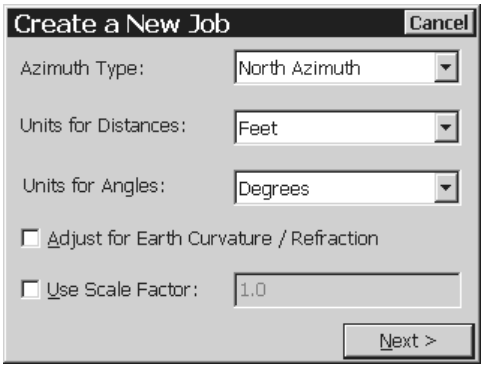
Directory: displays the directory where the current job will be stored.

Job Name: is where the name of the new job is entered. The default name is the current date.

Browse...: allows you to select a different directory where to store the new job.

Next >: accesses the second screen where job details are defined.

Create a New Job – Screen Two



Azimuth Type: specifies if you are surveying with a North Azimuth or South Azimuth.

Units for Distances: specifies if your distances will be entered in Feet, U.S. Feet, or Meters.

Note: You can enter a distance in any distance field in units other than what is set for the job by appending the distance value with the following characters:

- **f** or **ft** Feet
- **usf** or **usft** US Survey Feet
- **m** Meters
- **cm** Centimeters
- **mm** Millimeters
- **c** or **ch** Chains

Once the cursor leaves that field, the distance will be converted automatically. (A space between the value and the unit abbreviation is optional.)

Units for Angles: specifies if angles will be entered in Degrees or Grads.

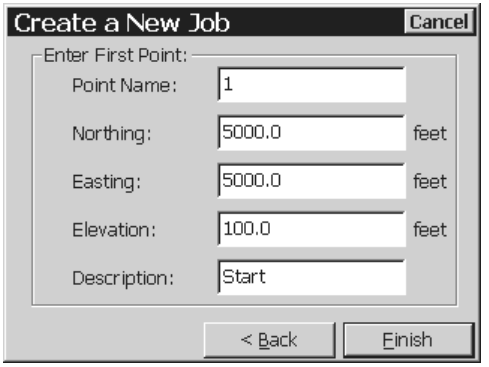
☑ **Adjust for Earth Curvature / Refraction**: when checked, the elevations recorded from all shots will be adjusted to compensate for earth curvature and refraction.

☑ **User Scale Factor**: when checked, all horizontal distances when taking shots will be adjusted by the scale factor entered here.

Next >: accesses the third screen where coordinates for the first point are defined and the job is saved.

Create a New Job – Screen Three

Point Name: is the name of the initial point.



Northing: is the Y-coordinate of the initial point.

Easting: is the X-coordinate of the initial point.

Elevation: is the elevation of the initial point.

Description: is the description of the initial point.

< Back: returns you to the first screen.

Finish: stores a new job file and raw data file using the specified information.

Open

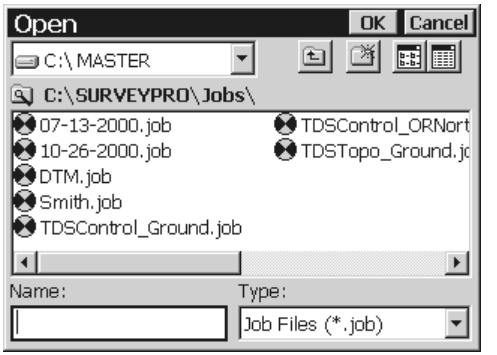
1 File | A Open / New | Browse...

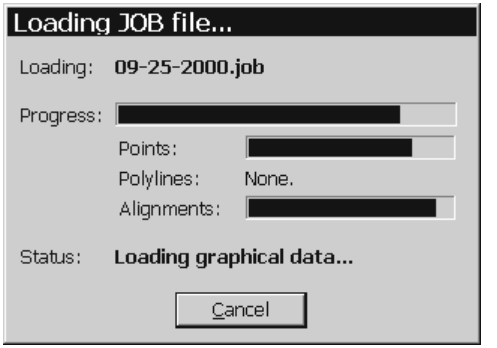
The Open screen is used to open an existing job.

A list of all the jobs in the current directory is displayed. Simply tap on the job name that you want to open and then tap OK.

Note: TDS CR5 files can be opened just like any Survey Pro JOB file. When a CR5 file is opened, it is automatically converted and stored to a JOB file with the same name. If a matching RW5 raw data file exists, it too will be converted and saved to a Survey Pro RAW file with a note inserted indicating that the conversion took place.

When a job is being opened, the Loading JOB file screen will open and display the status of the loading process.





Save As

1 File | B Save As

The Save As screen allows you to save a copy of the current job under a new name. The copy that is created will then become the current job.

The Save As dialog box is identical to that found in the Windows CE operating system. Simply enter a new name for the current job and then tap the Save button.

Note: It is not necessary to include the .JOB extension since it will automatically be added for you.

Import Coordinates

1 File | C Import Coordinates

The Import Coordinates screen is used to add the points from another source into the current job.

Warning: Coordinate values can change when they are imported!

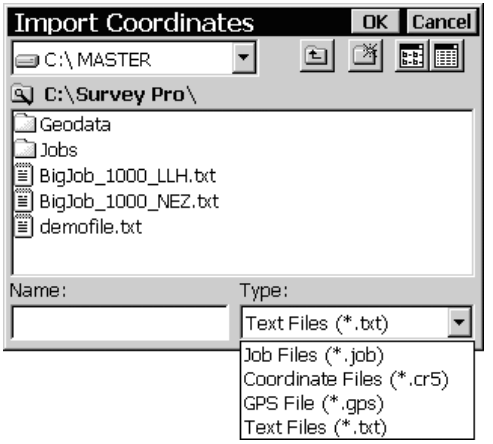
Importing coordinates from any source other than a JOB file requires that the distance units used in the source file be specified. It is not necessary to specify the distance units when importing coordinates from a JOB file since those units are written within the file.

If importing coordinates where the distance units in the source file are different than the distance units for the current job, the imported coordinates will be converted to the current job's distance units when they are imported. This is normally the desired result, but it can cause a problem if any distance units were set incorrectly. This situation can most commonly occur when working with Feet and US Survey Feet where the conversion from one to the other is not always obvious.

Usually the difference between Feet and US Survey Feet is negligible (2 parts per million), but when dealing with State Plane or UTM mapping plane coordinates, which are often very large in magnitude, the difference can be substantial if the coordinates are converted from one format to the other.

If importing coordinates from a source, such as an HP 48, where you are not sure if the units are in Feet or US Survey Feet into a job that is set to Feet or US Survey Feet, you will usually just want to import them without any conversion being performed. To do this, be sure to select the same distance units for the source file as those set for the current job.

Coordinates from a variety of file types can be imported into the current job. The first Import Coordinates screen is used to select from the file types listed below. The next screen that opens depends on the selection made here.



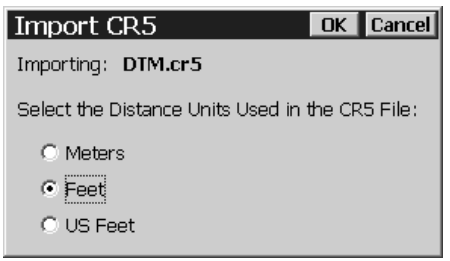
- **Job Files (*.JOB)**: import coordinates from another Job file.
- **Coordinate Files (*.CR5)**: import coordinates from a TDS CR5 coordinate file.
- **GPS Files (*.GPS)**: import coordinates from a TDS GPS coordinate file.
- **Text Files (*.TXT)**: text files can contain coordinates in several different possible formats. The Import ASCII Wizard is used to define the format of the text file being imported.

*Import *.JOB Coordinates*

When importing coordinates from another *.JOB file, the Import Coordinates screen is used, described above.

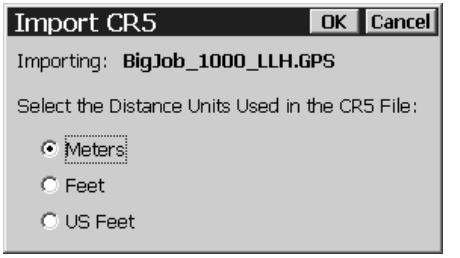
A list of all the jobs available in the current directory is displayed. Simply tap on the job name that you want to import and then tap the OK button. The points in the selected job will be added to the points in the current job.

*Import *.CR5 Coordinates*



The Import CR5 dialog box will open when importing coordinates from a TDS CR5 coordinate file. Simply select the distance units that the coordinates were stored in and tap OK.

Import *.GPS Coordinates

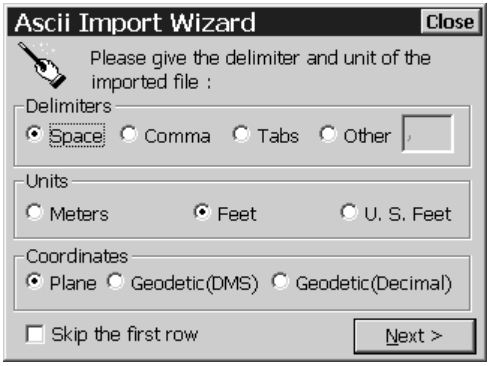


The Import CR5 dialog box will open when importing coordinates from a TDS GPS coordinate file. Simply select the distance units that the coordinates were stored in and tap OK.

When importing coordinates from both a TDS CR5 and GPS file from the same job, the GPS coordinate will be linked to the coordinates in the CR5 file. For more information on this, refer to the GPS User's Guide.

Import *.TXT Coordinates

Since the coordinates in an ASCII *.TXT file can be stored in a variety of formats, two screens are used to define the format of the file that is being imported. The source *.TXT file can contain either plane coordinates or geodetic coordinates.



Delimiters: is the character that separates each column of text in the ASCII file.

Units: are the units that the distances in the file were stored in.

Coordinates: is used to specify if the coordinates are plane coordinates, geodetic coordinates in degrees-minutes-seconds format, or geodetic coordinates in decimal format.

☑ **Skip the first row**: should be checked if the first line in the ASCII file contains non-coordinate information, such as a heading.

Next >: opens the second screen.

*Import *.TXT Coordinates – Screen Two*

Name Column No. / Start Point Name: When the first option is selected here, the column number used for the name field in the *.TXT file is specified here. When the second option is selected, it is assumed that the *.TXT file does not contain point names and will assign the first point the name specified here and increment to the next available point name for the remaining points.

Columns: is where the column number for each specified coordinate exists in the source *.TXT file. The coordinates types displayed here can either be for plane coordinates or geodetic coordinates depending on the selections made in the previous screen. If a coordinate has a checkbox, which is unchecked, it is assumed that the source *.TXT file does not contain columns for that type of coordinate.

☑ **Specify Missing Elevation Threshold**: if the source file was created from coordinates with no elevations, but the file contains an elevation column with values, such as 0, check this box and indicate the value in the field that will appear to the right.

Preview: opens the ASCII Import Preview window containing all the point data that will be imported. This is useful to check for errors before actually importing new data.

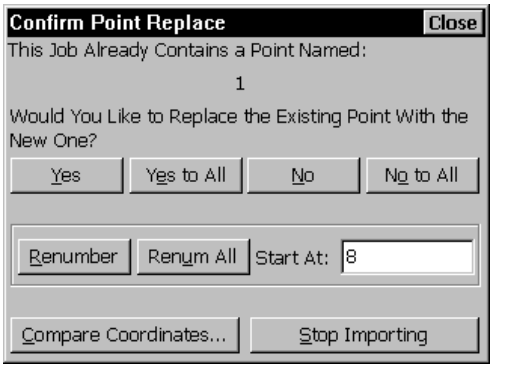
< Back: returns to the previous screen.

Finish: imports the new point data into the current project.

Confirm Point Replace Dialog Box

If a point being imported has the same name and the same coordinates as a point that is already in the current job, it is ignored and a message will be displayed after the remaining points are imported to indicate this.

If an imported point is encountered with the same name, but with different coordinates as a point in the current job, the Confirm Point Replace dialog box will open.



Yes: will replace the point in the current job with the point being imported.

Yes to All: will replace the point in the current job with the point being imported and perform the same action for any remaining duplicate points.

No: will not import the duplicate point, keeping the coordinates for the existing point unchanged.

No to All: will not import the duplicate point, keeping the coordinates for the existing point unchanged and perform the same action for any remaining duplicate points.

Renumber: will store the new point in the current job under the name specified in the Starting At field.

Renum All: will store the new point in the current job under the name specified in the Starting At field and perform the same action for any remaining duplicate points, storing them with the next available point name.

Start At: is the point name assigned to the imported point when using the Renumber or Renumber All function.

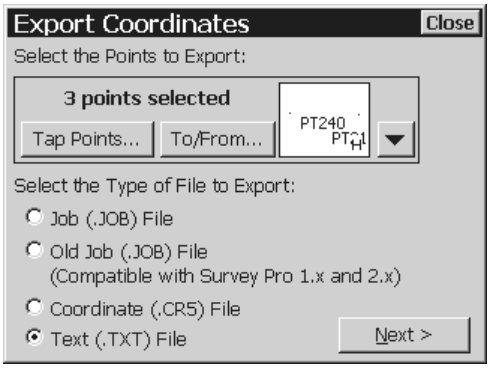
Compare coordinates...: will open a dialog box showing the coordinates for the duplicate points to assist in making a decision of how to handle the new point.

Stop Importing: will not import the current duplicate point and will stop importing any remaining points. All previous points will still be imported into the current job.

Export Coordinates

1 File | D Export Coordinates

The Export Coordinates screen allows you to export selected points from the current job to a new job or to a coordinate file in another format.



Tap Points...: allows you to select the points to export by tapping them from a map view.

To/From...: allows you to specify a range of points to export.

▼: The power button provides additional point selection options, which include selecting all control points, all non-control points and selection by description.

Job (.JOB) File: when selected, the points are exported to a TDS JOB file.

Old Job (.JOB) File: when selected, the points are exported to a TDS JOB file that is compatible with versions of Survey Pro for Windows CE earlier than 3.0.

Coordinate (.CR5) File: when selected, the points are exported to a TDS CR5 coordinate file format.

Text (.TXT) File: when selected, the points are exported to an ASCII text file.

Next >: opens the next screen, which is determined by the selected file type.

*Export *.JOB Coordinates*

When exporting to another *.JOB file, the Save As screen is opened where the file name and location is entered for the new *.JOB file.

Export *.CR5 Coordinates

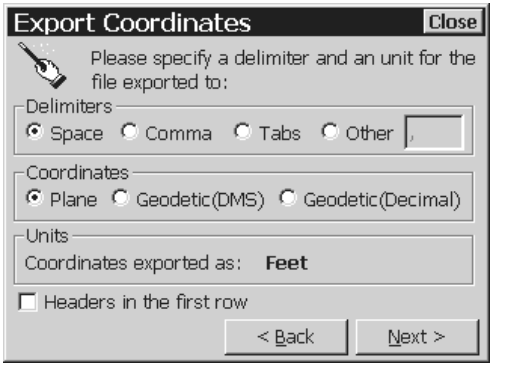
The Export CR5 dialog box will open when exporting coordinates to a TDS CR5 coordinate file.

CR5 File Options: specifies if the resulting file should be Sequential or Non-Sequential.

< Back: returns to the previous screen.

Export: exports the selected coordinates to the new CR5 file.

Export *.TXT Coordinates



Since the coordinates in an ASCII *.TXT file can be stored in a variety of formats, two screens are used to define the format of the resulting file.

Delimiters: is the character that separates each column of text in the ASCII file.

Coordinates: is used to select if the resulting coordinates should be plane coordinates, geodetic coordinates in degrees-minutes-seconds format, or geodetic coordinates in decimal format.

Units: are the distance units that will be written to the resulting TXT file. These units are automatically set to the same units that are set for the current job.

☑ **Headers in the first row**: when checked, a heading describing each column is inserted in the first row. For example, the following header could be inserted:

```
Name,Northing,Easting,Elevation,Description
```

< Back: returns to the previous screen.

Next >: opens the second screen.

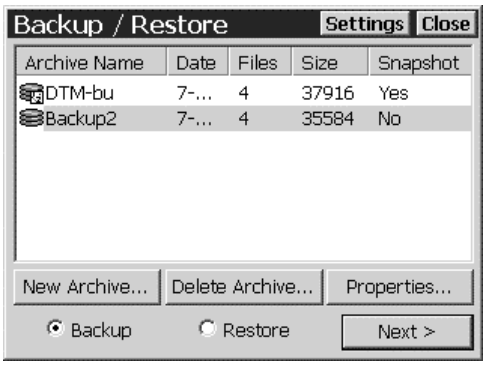
*Export *.TXT Coordinates – Screen Two*

Select the desired order and format for the resulting TXT file from the list of options.

Finish: exports the selected points to the TXT file.

Backup / Restore Job

1 File | E Backup / Restore



The Backup / Restore wizard is a series of screens that are used to backup or restore all the files associated with the current job.

The routine also gives you the option of storing a snapshot of a customized map view to the archive. This can then be used to visually identify an archive.

Any number of backups can be created for a particular job. All the existing backups for the current job are listed in the main Backup / Restore screen, along with other information including the date the backup was created, the number of files stored in the archive and if the archive includes a snapshot. Archives that include a snapshot are shown with a icon, while those without a snapshot have a icon.

All of the backups for a particular job are physically stored to a single compressed file located in the \Jobs directory on the data collector. This file will have the same filename as the current job, only the *.Backup extension is appended to the name. For example, the backups for a job with a filename of Smith.Job will be stored in a file called Smith.Job.Backup.

New Archive...: opens the New Archive dialog box where a name is entered for the new backup archive being created. Once created, an empty archive will be listed in the main Backup / Restore screen, which can then be selected to backup the current job.

Delete Archive...: opens a prompt asking if you are sure. If you select Yes at the prompt, the archive selected from the main Backup / Restore screen will be deleted.

Properties...: opens the Archive Properties screen.

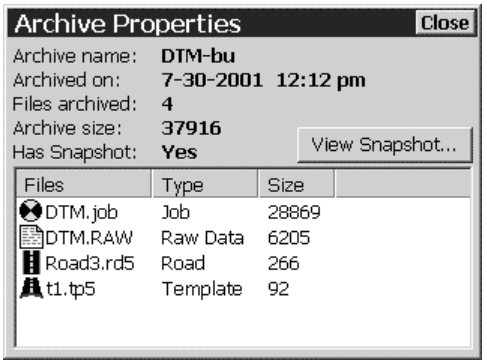
Backup: when selected, tapping Next> will begin the backup routine where the data for the current job will be stored to the selected archive.

Restore: when selected, tapping Next> will begin the restore routine where the data from the selected archive will be restored, overwriting the current job.

Next>: accesses the next screen.

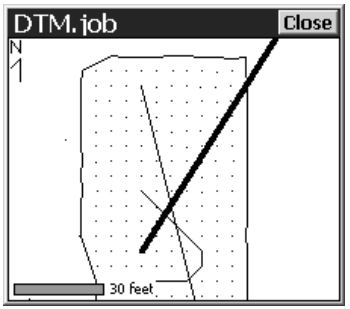
Backup / Restore - Archive Properties

1 File | E Backup / Restore | Properties...



The Archive Properties screen lists the files stored within the selected archive along with other information.

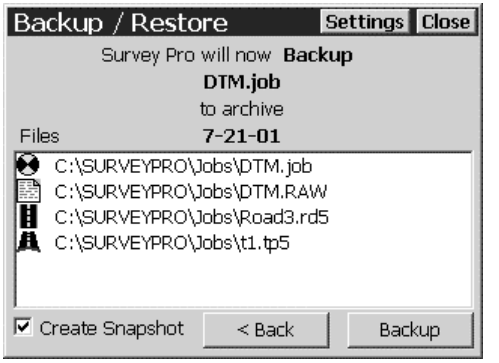
The file sizes listed in this screen are in bytes. Since all backup archives are compressed, the file sizes displayed represent the compressed files, or the amount of space actually being used by the file(s) on the data collector.



View Snapshot...: will display the snapshot from the selected archive if one was included when the archive was originally created.

Backup / Restore – Backup

When performing a backup, all the files associated with the current job are listed and will be included in the archive.



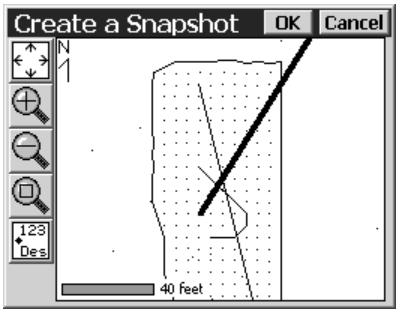
☑ **Create Snapshot**: when checked, the next screen will prompt you to create a snapshot of the current job's map view, which will then be included in the archive.

< Back : returns to the previous screen.

Backup : accesses the next screen.

Backup / Restore - Create a Snapshot

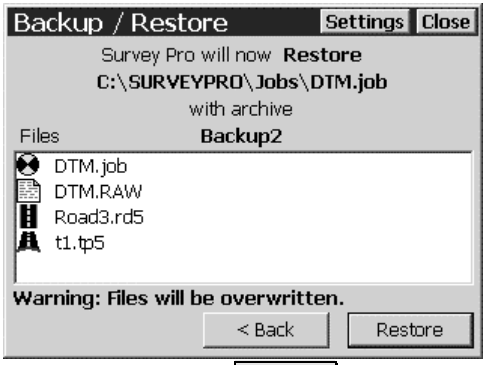
The Create a Snapshot screen is a map view that is used to configure the map as desired and the resulting image will be saved in the archive as a snapshot along with the job files.



OK : will create the archive along with a snapshot of the map as it is configured on the screen.

Cancel : will create the backup archive without a snapshot.

Backup / Restore – Restore



When restoring the job files from an archive, the archived files will replace the existing files of the current job.

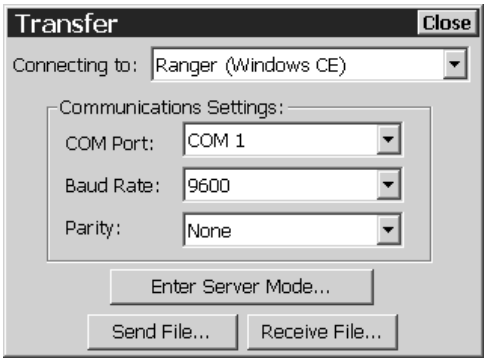
Warning: If you do not want to lose any new data that was collected after the archive being restored was created, you should first backup the current job to a new archive before restoring an older archive.

< Back : will return to the previous screen.

Restore : will restore the backed up job from the selected archive. The current job is then deleted and replaced by the backup job.

Transfer

1 File F Transfer



The Transfer screen allows you to transfer files between the data collector and another device running TDS software.

Connecting to: specifies which device you are communicating with from the following options:

- HP48: if you are connecting to a Hewlett Packard HP48 calculator.
- Husky (DOS): if you are connecting to a Husky FS-series data collector.
- Ranger (Windows CE): if you are connecting to another Ranger data collector.
- Windows PC: if you are connecting to a personal computer that is running Windows CE Services.
- Geodimeter 600: if you are connecting to a Geodimeter 600-series total station running TDS onboard software.

COM Port: specifies which COM port you are using on the local machine. (COM 1 is the only available serial port on a Ranger.)

Baud Rate: specifies the communications speed. The baud rate must match in both units for successful communications.

Parity: specifies the parity. The parity must match in both units. When in doubt, select None here. All transfers are controlled from the PC when in this special mode.

Enter Server Mode: places the data collector in server mode where all file transfers are controlled from a PC running either TDS Survey Link or TDS ForeSight. Tapping Cancel will disconnect server mode.

Send File...: will open the Open dialog box where the file that you want to send can be selected. Once selected, the file is sent from the data collector to the specified device. A progress bar will be displayed

that indicates how much of the file has been transferred. Tapping Cancel will stop the file transfer.

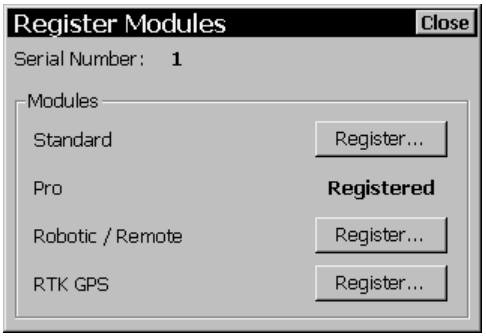
Note: The Send routine should be initiated shortly after issuing the receive command on the other device.

Receive File...: allows you to receive a file from another device. This should be tapped prior to issuing the Send command on the other device. Tapping Cancel will stop the file transfer.

Register Modules

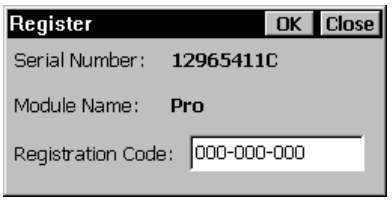
1 File | G Register Modules

The Register Modules screen is used to upgrade the Survey Pro software. Refer to the User's Manual for more information on registering additional modules.



If no modules have been registered, Survey Pro will run in Demo Mode. When running in Demo Mode, users are able to test and use every routine available in the software, as if the Survey Pro Max module was purchased. Although, Demo Mode limits all jobs to no more than 25 points. If a job exists on the data collector that contains more than 25 points, it cannot be opened while running in Demo Mode.

Registered: Indicates that the corresponding module has been added.



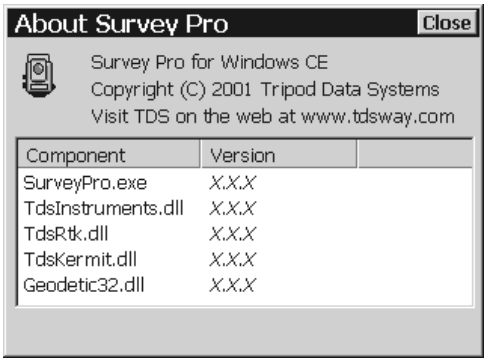
Register...: Opens the Register dialog box, shown, where the registration number for a particular module can be entered.

About Survey Pro

1 File | H About Survey Pro

The About screen displays the version of the Survey Pro CE software and the versions of several of the Survey Pro software files, which can be updated from the TDS Website.

Ranger Information: (button not shown) is a shortcut to the Microsoft System Properties screen, which is normally accessed from the Windows CE Control Panel. Tap the ? button in the title bar of this screen to view the online help.



Exit

1 File | I Exit

This will close the Survey Pro CE software and return you to the operating system installed on your data collector.

Job Menu

A: Settings

B: Edit Points

C: Edit Polylines

D: Edit Alignments

E: Auto Linework

F: View Raw Data File

G: View DTM

H: Manage Layers

I: Job Information

J: Calculator

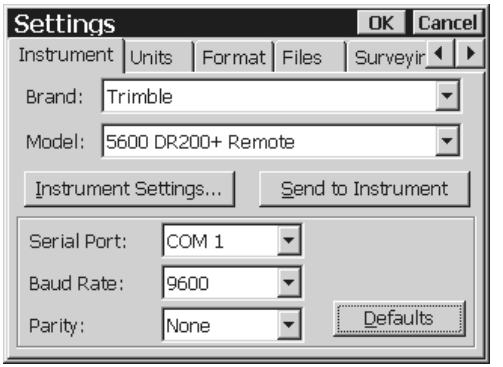
Settings

2 Job | A Settings

The Settings screen contains several individual screens that are in an index card format. When the tab of a "card" is tapped, the settings indicated by the label of that tab are accessed.

Note: You can scroll to additional tabs when they are not in view by using the ◄ ► buttons.

Instrument Settings



The Instrument Settings are used to define the type of total station or laser range finder that is being used so it can communicate with the data collector. The information on this screen will vary depending on the total station model selected.

Brand: is where you specify the manufacturer of the instrument that you are using from a dropdown list. When set to << Manual >>, all data collection input must be manually entered from the keypad.

Model: is where you specify the model of the instrument that you are using from a dropdown list.

Instrument Settings...: accesses the settings that are specific for the selected total station. This screen can also be accessed with the Ctrl-[W] hotkey. (See the notice below.)

Send to Instrument: (applicable only to specific total stations) will send the selected instrument settings to the total station. This is particularly useful with robotic total stations after the total station has been reset.

Serial Port: is the serial port on the data collector used for communications with the total station.

Baud Rate: is the speed at which communication occurs with the total station. This must match the baud rate configured within the total station.

Parity: is the parity used for communication with the instrument. This must match the parity setting configured within the total station.

Defaults: will set the Serial Port, Baud Rate and Parity to their default values based on the selected total station.

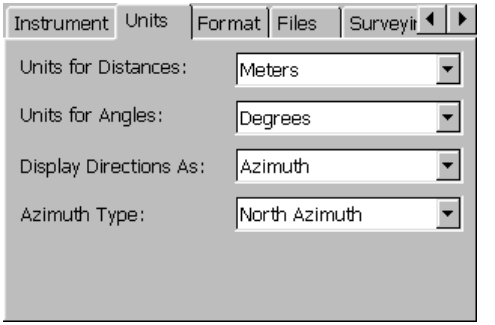
NOTICE:

The settings that are available after tapping the Instrument Settings... button directly control the settings that are built into the selected total station. Since total station manufactures release new models every year, TDS cannot maintain the necessary set up documentation for every existing model and the models that are not yet available. The set up procedure for your particular total station is better handled by the total station manufacturer, or your instrument's dealer.

If you have specific questions on the set up of your total station you should refer to the documentation that was included with your total station. The numbers listed below are provided for your convenience:

Trimble:	800-538-7800
Zeiss:	800-538-7800
Geodimeter:	800-538-7800
Leica:	800-327-4773
Nikon:	516-547-8500
Pentax:	800-729-1419
Topcon:	800-223-1130

Units Settings



The Units Settings card defines the units that are used within the software, sent from the total station, entered from the keypad and displayed on the screen. You can select the following settings for your project from the following dropdown lists.

Units for Distances: defines the units used for length as Meters, Feet, or US Survey Feet.

Note: You can enter a distance in any distance field in units other than what is set for the job by appending the distance value with the following characters:

- **f** or **ft** Feet
- **usf** or **usft** US Survey Feet
- **m** Meters
- **cm** Centimeters
- **mm** Millimeters
- **c** or **ch** Chains

Once the cursor leaves that field, the distance will be converted automatically. (A space between the value and the unit abbreviation is optional.)

Warning: When creating a new job, it is important that the Units for Distances field be set to the correct units. This allows you to seamlessly switch between different units in mid-job.

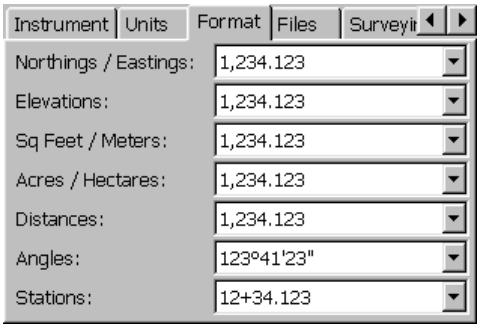
Problems can arise if these units are inadvertently set to the incorrect units when entering new data. For example, assume you created a control file by hand-entering a list of coordinates in a new job where the job was set to Feet and the coordinates being entered were in US Survey Feet. Now assume you created another new job and correctly set it to US Survey Feet. If you then selected the previous job as a control file for the new job, the display of all of the coordinates in the control file would be converted from Feet to US Survey Feet.

Units for Angles: defines the units used for angles as Degrees or Grads (gons).

Display Directions as: will display directions as a Bearing or Azimuth.

Azimuth type: defines if you are using a North Azimuth or a South Azimuth.

Format Settings



The Format Settings card defines the number of places beyond the decimal point that is displayed for various values in all screens and how stations are defined. (All internal calculations are performed using full precision.)

Northings / Eastings: will allow you to display from zero to six places passed the decimal point for northing and easting values.

Elevations: allows you to display from zero to six places passed the decimal point for elevations.

Sq feet / meters: allows you to display from zero to four places passed the decimal point for square feet or square meter values.

Acres / Hectares: allows you to display from zero to four places passed the decimal point for acre or hectare values.

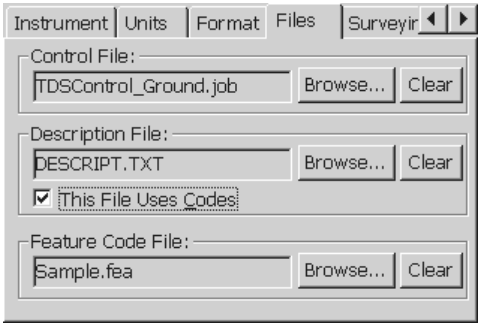
Distances: allows you to display from zero to six places passed the decimal point for distances.

Angles: allows you to include from zero to four fractional seconds with angle values.

Stations: allows you to display stations in any of the following formats:

- 12+34.123: displays stations where the number to the left of the + advances after traveling 100 feet or meters.
- 1+234.123: displays stations where the number to the left of the + advances after traveling 1,000 feet or meters.
- 1,234.123: displays standard distances rather than stations.

Files Settings



Control File: allows you to select a control file to use with the current job. Control files are explained in more detail in the User's Manual.

Note: A control file will not load if any point name in the control file matches a point name in the current job.

Note: When a control file is open, a note is written to the raw data file to indicate this.

Note: See the warning under Units Settings, above, pertaining to distance units when using a control file.

Description File: allows you to select a description file to use with the current job.

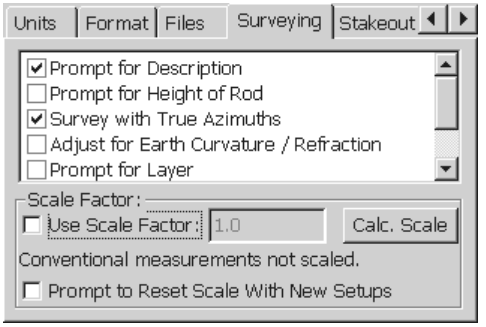
☑ **This file uses codes**: check this box if the description file contains codes and associated descriptions. Leave the box unchecked if the description only contains descriptions (no codes).

Feature Code File: displays the selected feature code file to use with the current job. See the User's Manual for more information on feature codes.

Browse: Allows you to select a file to use with the current job. Simply tap on the filename and then tap Open.

Clear: closes the currently selected file so that it is no longer used with the current job.

Surveying Settings



The Surveying Settings card allows you to select various options that affect how data collection is performed.

☑ **Prompt for Description**: when checked, a prompt for a description will appear before any new point is stored from only the routines under the Survey menu (Page R-71).

Note: Descriptions can be no longer than 16 characters.

☑ **Prompt for Height of Rod**: when checked, a prompt for the rod height will appear before any new point is stored.

☑ **Survey with True Azimuths**: automates the process of adjusting the circle on the total station when traversing so that you can survey with azimuths rather than horizontal angles (see Page R-77).

☑ **Adjust for Earth Curvature / Refraction**: when checked, the elevations for new points are adjusted to compensate for the curvature of the earth and refraction.

☑ **Prompt for Layer**: when checked, a prompt to select a layer will appear before any new point is stored from only the routines under the Survey menu (Page R-71).

☑ **Prompt for Attributes**: when checked, a prompt to select feature information will appear before any new point is stored from only the routines under the Survey menu (Page R-71). This also requires that a feature file be selected from the Files Settings card, described above.

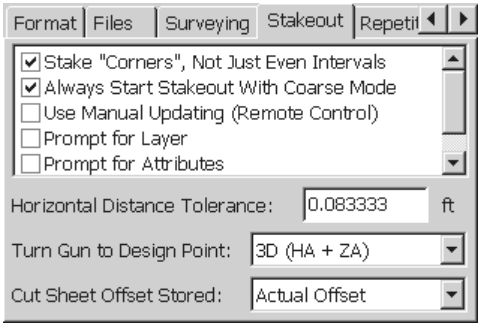
☑ **Use Scale Factor**: when checked, horizontal distances to all new points will be scaled by the factor entered here. (Elevations are not affected.)

Calc. Scale: allows you to automatically compute the scale factor from a selected map projection. If a mapping plane is not already selected, you will first be prompted to select one.

☑ **Prompt to Reset Scale on New Setups**: if checked when a map projection is selected and you set up over a new location, the specified scale factor is compared to the scale factor defined for your current location in the mapping plane. If the scale factor is different, you will be prompted to use the new scale factor.

Stakeout Settings

The Stakeout Settings card contains the setting that control how stakeout is performed.



☑ **Stake "Corners," Not Just Even Intervals**: when staking by stations, locations where a line segment changes, such as from a straight section to a curve, will also be staked when this is checked.

☑ **Always Start Stakeout With Coarse Mode**: when checked, the Coarse EDM (fast shot) checkbox found in all stakeout screens will initially be checked. This instructs the total station to measure distances faster, but with slightly less accuracy.

☑ **Use Manual Updating (Remote Control)**: When this is checked, a Shot button in the stakeout screens must be pressed to take a shot. When this not checked, shots are continuously taken in the stakeout screens. (This is only valid when running in remote mode, using a robotic total station.)

☑ **Prompt for Layer**: when checked, a prompt to select a layer will appear before any new point is stored from only the routines under the Stakeout menu.

☑ **Prompt for Attributes**: when checked, a prompt to select feature information will appear before any new point is stored from only the routines under the Stakeout menu. This also requires that a feature file be selected from the Files Settings card, described earlier.

Note: There is no Prompt for Description checkbox as in the Surveying Settings card because you are always prompted for a description when storing a point from a stakeout routine.

Horizontal Distance Tolerance: this setting affects the Remote Staking and Stake to Line routines (Page R-110). When staking to a line and the prism is located at a perpendicular distance to the specified line that is within the range set here, a message will state that you are on the line. When performing Remote Stakeout, the final graphic screen that is displayed when you are near the stake point will occur when you are within the distance to the stake point specified here.

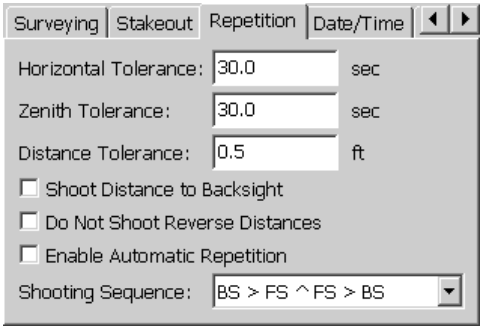
Turn gun to design point: only applies to motorized total stations. The following options are available:

- 2D (HA only): A motorized total station will turn horizontally toward the design point after tapping the Turn Gun button in the particular stakeout screen.
- 3D (HA and ZA): A motorized total station will turn horizontally and vertically toward the design point after tapping the Turn Gun button in the particular stakeout screen.
- Automatic 2D (HA only): A motorized total station will automatically turn horizontally toward the design point when the stakeout screen opens.
- Automatic 3D (HA and ZA): A motorized total station will automatically turn horizontally and vertically toward the design point when the stakeout screen opens.

Cut Sheet Offset stored: The cut sheet offset information can be stored to the raw data file in either of the following formats when performing any offset staking routine:

- Design Offset: when selected, a cut sheet report will list the design-offset values.
- Actual Offset: when selected, a cut sheet report will list the measured-offset values.

Repetition Settings



The Repetition Settings card contains the settings that control how repetition shots are performed and acceptable tolerances.

Horizontal Tolerance: a warning message will be displayed if a horizontal angle exceeds the tolerance entered here during a repetition shot.

Zenith Tolerance: a warning message will be displayed if a vertical angle exceeds the tolerance entered here during a repetition shot.

Distance Tolerance: a warning message will be displayed if a distance exceeds the tolerance entered here during a repetition shot.

☑ **Shoot Distance To Backsight**: when checked, a distance will be measured to each shot to the backsight. When unchecked, only the angles are measured.

☑ **Do Not Shoot Reverse Distances**: when checked, distances are not measured during reverse shots.

☑ **Enable Automatic Repetition**: when checked, all remaining shots after the first shot to the backsight and foresight will occur automatically when using a motorized instrument.

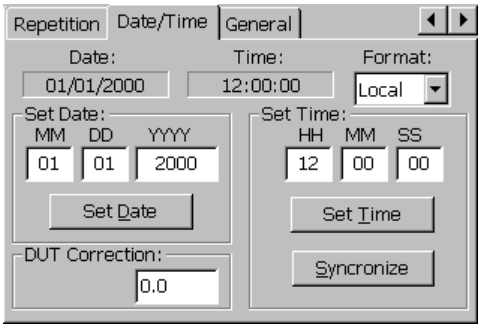
Shooting Sequence: specifies the order that the shots are taken from the following options:

- BS > FS ^ FS > BS: Backsight, Foresight, *reverse* Foresight Backsight
- BS > FS ^> BS > FS: Backsight, Foresight, *reverse* Backsight, Foresight
- BS ^ BS > FS ^ FS: Backsight, *reverse* Backsight, Foresight, *reverse* Foresight
- FS ^ FS > BS ^ BS: Foresight, *reverse* Foresight, Backsight, *reverse* Backsight
- FS > BS ^ BS > FS: Foresight, Backsight, *reverse* Backsight, Foresight

- FS > BS ^> FS > BS: Foresight, Backsight, *reverse* Foresight, Backsight

Date/Time Settings

The Date/Time Settings card is used to set the date and time in the data collector.



Date: displays the current date.

Time: displays the current time.

Format: Select Local to display your local time, or UTC to display Coordinated Universal Time.

Note: The date, time and UTC are computed using Windows CE's Date/Time properties.

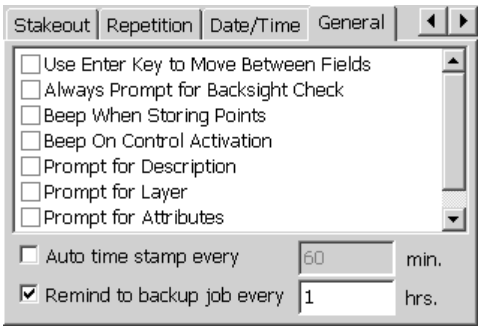
Set Date: will set the system date with the date that is entered.

Set Time: will set the system time with the time entered.

DUT Correction: is the polar wandering correction factor, in seconds, used to convert UTC to UT1. (UT1=UTC+DUT)

Synchronize: when pressed, will zero the fractional portion of the current time and advance to the nearest second so that the time can be set more accurately.

General Settings



The General Settings card contains the following miscellaneous settings:

☑ **Use Enter Key to Move Between Fields**: when checked, the [**Enter**] key will move the cursor to the next field in all screens. When unchecked, the [**Enter**] key will perform a different function depending on the field selected.

Note: The arrow keys and the [**Tab**] key can also be used to move the cursor between fields.

☑ **Always Prompt for Backsight Check**: when checked, if you exit the Backsight Setup (Page R-72) screen without performing the Check Backsight routine (Page R-73), a prompt will first ask if you are sure.

☑ **Beep When Storing Points**: when checked, an audible beep occurs when a point is stored.

☑ **Beep On Control Activation**: when checked, a sound occurs when an active area of the screen is tapped, such as a button or checkbox.

☑ **Prompt for Description**: when checked, a prompt for a description will appear before any new point is stored from any routine other than those included in the Survey and Stakeout menus.

Note: Descriptions can be no longer than 16 characters.

☑ **Prompt for Layer**: when checked, a prompt to select a layer will appear before any new point is stored from any routine other than those included in the Survey and Stakeout menus.

☑ **Prompt for Attributes**: when checked, a prompt to select feature information will appear before any new point is stored from any routine other than those included in the Survey and Stakeout menus. This also requires that a feature file be selected from the Files Settings card, described earlier.

☑ **Backup Reminder When Closing Job**: when checked, a reminder will open to backup the current job prior to closing it.

☑ **Auto time stamp every ___ min**: when checked, will store a note record to the raw data file containing the current date and time each time the specified number of minutes passes. This is useful for tracking down when specific raw data records were written to the file.

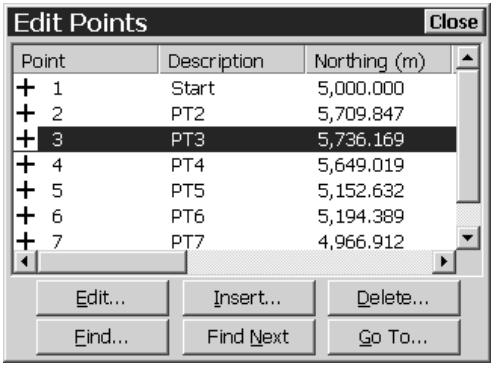
☑ **Remind to backup job every ___ hrs**: when checked, will open a reminder to backup the current job after every specified number of hours passes.

Edit Points

2 Job | B Edit Points

The Edit Points screen allows you to add, edit, and delete any points in the current job.

Edit...: if only a single point is selected, this will open the point in the Edit Point screen (Page R-40) where the details of the point can be modified. If more than one point is selected, the next Edit Points screen will open where the description and layer for the selected points can be modified simultaneously.



Note: as with most Windows applications, a series of points can be selected by holding down the shift key while selecting the first and last point within a range of points. Multiple random points can be selected/unselected by holding down the control key while tapping them.

Note: Double tapping on a point will also open the point in the editor.

Note: The current occupy and backsight points cannot be edited.

Insert...: opens a dialog box where a new point can be added to the current job.

Delete...: will delete the selected point.

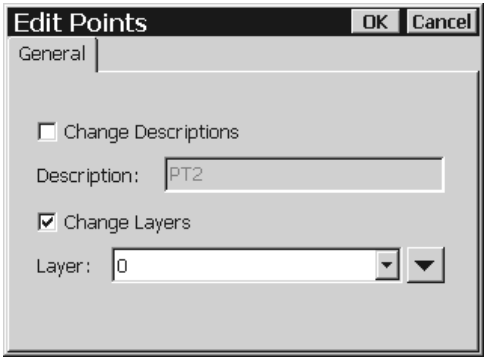
Find...: will search for a point by its description.

Find Next: will find the next point that contains the description entered when using the Find... button (above).

Go To...: opens a dialog box where any point can be quickly located by the entered point name.

Edit Points – (multiple point editing)

2 Job | B Edit Points | Edit...



This screen is accessed after pressing Edit... when more than one point is selected. The change made in this screen will be applied to all the selected points.

Change Descriptions: When checked, allows you to change all the selected point's descriptions to the Description entered in the next field.

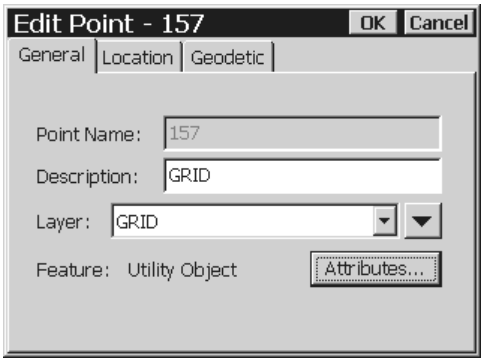
Description: is the new description that will replace the existing descriptions for the selected points.

Change Layers: When checked, allows you to move the selected points to the layer selected in the next field.

Layer: is the layer where the selected points will be moved.

Edit Point – General

2 Job | B Edit Points | Edit... | General



The General card of the Edit Point screen is used to modify the description, layer and feature information for the selected point.

Point Name: displays the selected point's name.

Description: is the description for the selected point.

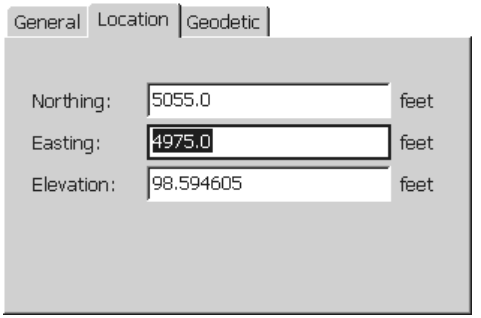
Layer: is the layer for the selected point.

Feature: displays the feature assigned to the selected point, which can be modified using the Attributes button.

Attributes: accesses the Point Feature Attributes screen (Page R-43) where the feature attributes for the point can be modified.

Edit Point – Location

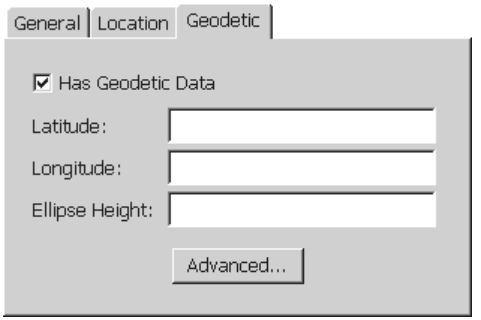
2 Job | B Edit Points | Edit... | Location



The Location card is used to modify the northing, easting and elevation of the selected point.

Edit Point – Geodetic

2 Job | B Edit Points | Edit... | Geodetic



The Geodetic card applies primarily to Survey Pro with GPS users. Refer to the GPS Reference Manual for more information on this card.

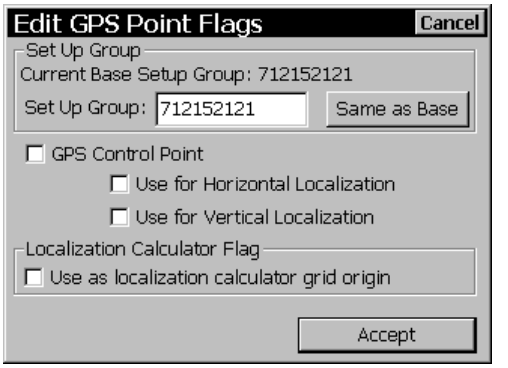
☑ **Has Geodetic Data**: when checked, this allows you to edit the geodetic coordinates for a point.

Advanced...: will open the Edit GPS Point Flags screen to select the advanced settings for the selected point.

Edit GPS Point Flags Screen

2 Survey | D Control Points | Edit Point | Set Flags

The Edit GPS Point Flags screen is used to select the advanced settings for the selected point.



Set Up Group: is the set up group of the point. (See the User's Manual for more information on set up groups.)

GPS Control Point: when checked, will include the selected point in the list of localization control points.

Use for Horizontal Localization: when checked, will use the point for horizontal control in the localization solution.

Use for Vertical Localization: when checked, will use the point for vertical control in the localization solution.

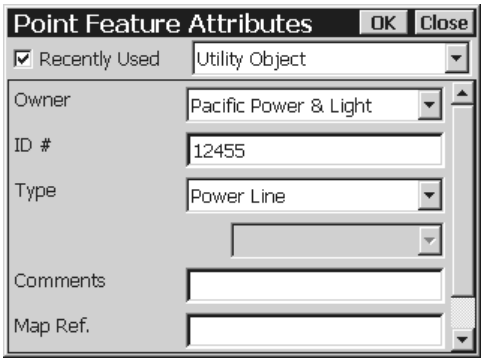
Use as localization calculator grid origin: when checked, identifies the selected point as the local grid origin for computing rotation in localization calculator solutions. (See the GPS User's Manual for more information on localization calculator.).

Accept: accepts the screen selections and returns to the previous screen.

Point Feature Attributes

2 Job | B Edit Points | Edit... | General | Attributes...

The Point Feature Attributes screen is available from the above path or whenever a point is stored when Prompt for Attributes is checked in the Surveying Settings screen (Page R-33).



Recently Used: when checked will arrange the order of the available features so the most recently used features are listed first. Any feature in the current feature file can be selected from the corresponding drop-down list.

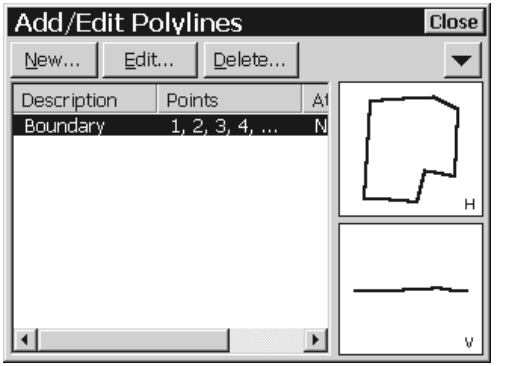
The content displayed in the main portion of the window fully depends on the attribute information associated with the selected feature.

Note: Feature files are created using the Survey Attribute Manager included with TDS Survey Link, Version 7.2 or later.

Edit Polylines

2 Job | C Edit Polylines

The Edit Polylines screen is used to add, edit, and delete polylines in the current job.



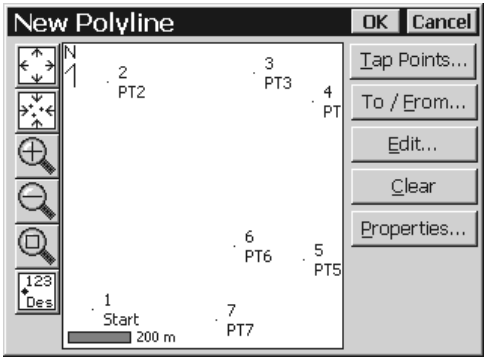
The first screen will display a list of all the polylines that are stored in the current job. Selecting any of the polylines listed will display a horizontal (overhead) and vertical (side) view of that polyline.

Edit... : will open the selected polyline in the New Polyline screen, described below.

Delete... : will delete the selected polyline.

New... : will open the Polyline Editor where a new polyline can be created.

Screen Two – New Polyline



The second screen is used to define all of the points that are used in the polyline. Any curve information will be entered later, but the end points must still be selected at this point.

The current polyline is shown on color displays with bold red lines and all other polylines are shown using thin black lines. Only the current polyline data can be edited.

Tap Points... : opens a map view where the points in your polyline can be tapped. They must be tapped in the order that they occur in the polyline.

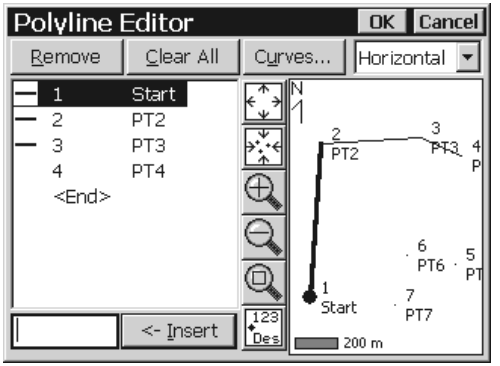
To/From... : Allows you to define a range of points to define a polyline.

Edit... : Accesses the third screen, described next, where the current polyline can be modified.

Clear : removes the current polyline.

Screen Three – Polyline Editor

Once the initial points are selected for the current polyline, the third screen allows you to modify the polyline and define any curve and grade information for the polyline sections.



Selecting any point in the left column of the screen will select that point and the line segment that follows it up to the next point. The selected section is then highlighted in the map portion of the screen. Any edits will occur on the selected section.

Remove : will remove the selected point and the line segment that follows it. The previous line segment will be automatically joined to the following point. The change will only be saved if you then tap OK. Tapping Cancel will return to the previous screen without saving the changes.

Clear All : will completely remove the current polyline. The change will only be saved if you then tap OK. Tapping Cancel will return to the previous screen without saving the changes.

Curves... : Accesses the fourth screen, described below, where a horizontal, vertical, or spiral curve can be added to the selected polyline segment.

Horizontal / **Vertical**: toggles between showing the map in a Horizontal (overhead) view or a Vertical (side) view.

<- Insert : allows you to insert a point, or a group of points in front of the selected point. The change will only be saved if you then tap OK. Tapping Cancel will return to the previous screen without saving the changes.

Note, if <End> is selected in the list, the <-Insert button will change to an <-Append button to indicate that additional points will be appended to the end of the list.

Screen Four – Add/Edit Curve

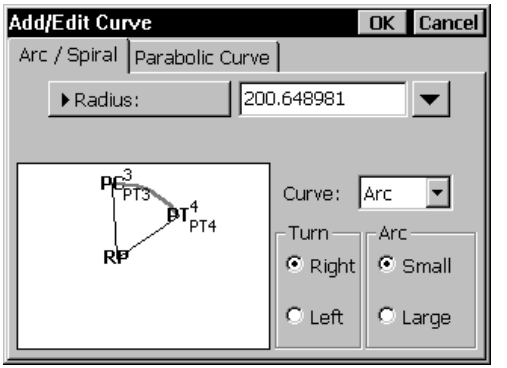
The fourth screen is used to modify a selected polyline segment that occurs between two points. A horizontal, vertical, and/or spiral curve can be applied to the polyline segment.

Adding a Horizontal Curve

Tap the Arc / Spiral tab.

Curve: must be set to Arc to enter a horizontal curve.

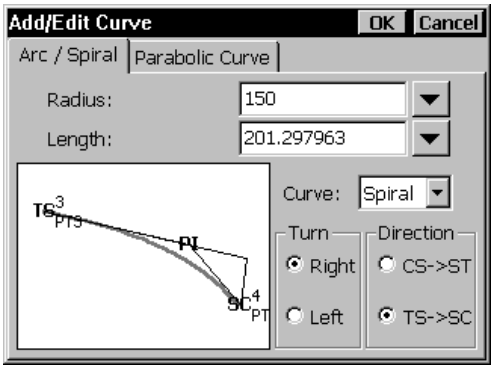
▸Radius / ▸Delta / ▸Degree Arc / ▸Degree Chord: allows you to specify the radius of the curve using a variety of methods.



Turn: specifies if the curve turns toward the Right or Left as you occupy the initial point and face the end point.

Arc: specifies if the arc of the curve is Small (less than 180°) or Large (greater than 180°).

Adding a Spiral



Tap the Arc / Spiral tab.

Curve: must be set to Spiral to enter a spiral curve.

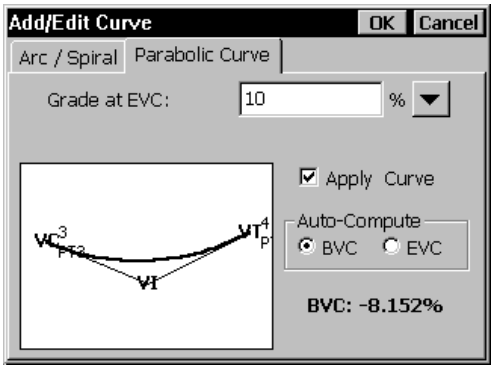
Radius: is the radius of the spiral curve. (The same radius of the circular curve adjacent to the spiral.)

Length: is the length of the spiral, measured along the curve from the TS to the SC.

Turn: specifies if the spiral curve turns to the Right or Left as you occupy the initial point and face the end point.

Direction: specifies if the curve runs from where the tangent intersects with the spiral toward where the spiral intersects with the curve (TS->SC) or if the curve runs from where the curve intersects with the spiral toward where the spiral intersects with the tangent (CS->ST).

Adding a Vertical Curve



Tap the Parabolic Curve tab.

☑ **Apply Curve**: must be checked to enter a vertical at curve.

Grade at EVC / **BVC** is the known grade at either the end of vertical curve or beginning of vertical curve. The grade entered here is determined by the selection made in the Auto-Compute field.

Auto-Compute: will automatically compute the grade at the selected point and display it at the bottom of the screen. The grade at the point that is not checked here must be specified in the field defined above.

Edit Alignments

The Edit Alignments screen is used to create and edit alignments, which can then be used with routines such as Offset Staking, Offset Points, Offset Lines and Road Layout.

Alignments are used to describe all of the horizontal and vertical details of a road's centerline. An alignment does not use existing points to define any particular locations on the alignment, although a point can be used to anchor the starting location, which is the same location for both the horizontal and vertical parts of the alignment. Any location on an alignment where a change occurs is called a *node*.

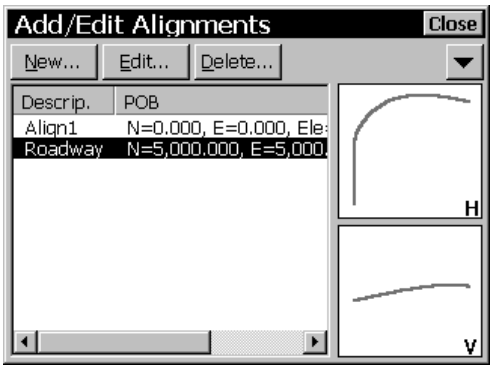
An alignment can contain straight sections, grades, horizontal, vertical, and spiral curves. The horizontal and vertical portions of an alignment are defined separately and independently, but they are both combined within the software to create a single alignment with horizontal and vertical characteristics.

Add / Edit Alignments

2 Job | D Edit Alignments or

8 Roads | B Edit Alignments

The Add / Edit Alignments screen displays a list of all the existing alignments in the current job. The right portion of the screen shows a graphic of the horizontal and vertical portion of the selected alignment.



New...: opens the Edit Alignment screen where a new alignment can be created from scratch.

Edit...: opens the Edit Alignment screen where the details of the selected alignment can be edited.

Delete...: is used to delete the selected alignment.

▼: The power button accesses the following routines:

- **Create Points**: opens the Create Points screen (Page R-232) where points can be stored that coincide with the selected alignment.
- **Import .RD5 File**: opens the Open screen and lists all the *.RD5 alignment files in the Jobs directory. Select the desired file and tap OK.
- **Export .RD5 File**: opens the Save As screen where the current alignment can be saved to a *.RD5 file.

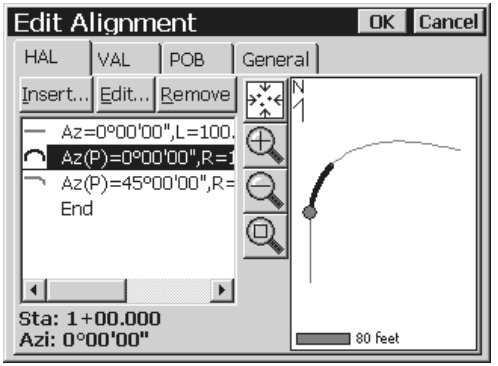
Edit Alignment

2 Job | D Edit Alignments | Edit... or

2 Job | D Edit Alignments | New...

The Edit Alignment screen is used to edit an existing alignment or create a new one.

Edit Alignment Screen – HAL Tab



The HAL (**H**orizontal **AL**ignment) tab in the Edit Alignment screen is used to enter or modify only the horizontal details of an alignment.

Insert...: opens the Edit Segment screen where a new horizontal alignment segment can be inserted prior to the selected segment.

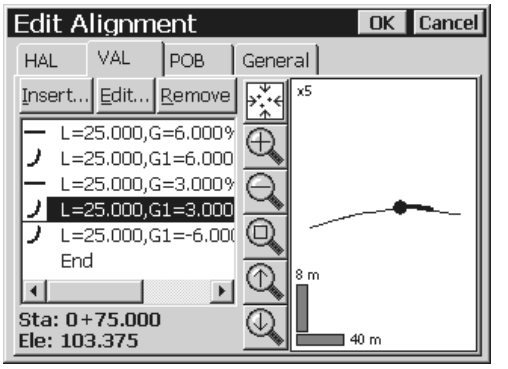
Edit...: opens the Edit Segment screen where the selected horizontal segment can be modified.

Remove: removes the selected segment and automatically joins the next segment with the previous segment.

Note: The station and azimuth at the beginning of the selected horizontal segment are displayed at the bottom of the screen.

Edit Alignment Screen – VAL Tab

The VAL (**V**ertical **AL**ignment) tab in the Edit Alignment screen is used to enter or modify only the vertical details of an alignment.



Note: The total horizontal length of the VAL must be equal to or greater than the total horizontal length of the HAL when the alignment is used for road layout.

Insert...: opens the Edit Segment screen where a new vertical segment can be inserted prior to the selected segment.

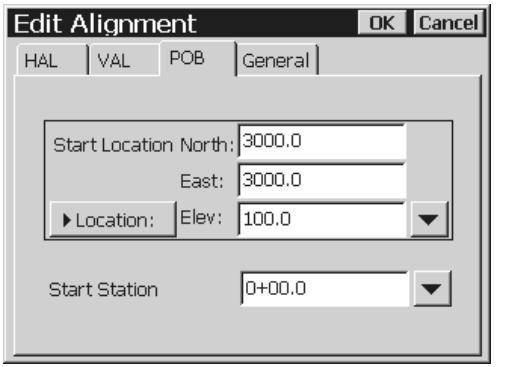
Edit...: opens the Edit Segment screen where the selected vertical segment can be modified.

Remove: removes the selected segment and automatically joins the next segment with the previous segment.

Note: The station and elevation at the beginning of the selected vertical segment are displayed at the bottom of the screen.

Edit Alignment Screen – POB Tab

The POB (**P**oint **O**f **B**eginning) tab in the Edit Alignment screen is used to define the starting location of the alignment. The first horizontal and vertical segment will always begin at this location.

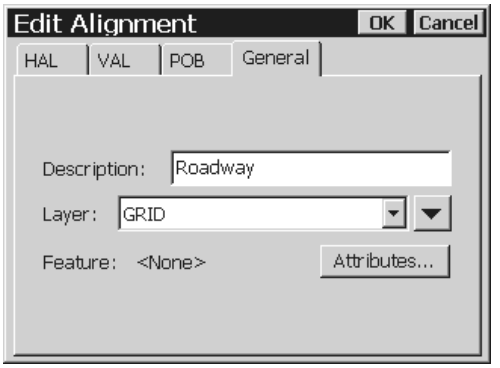


Location: the starting location for the horizontal and vertical alignments will be at the specified North, East and Elev coordinates.

Point: the starting location for the horizontal and vertical alignments will be at the specified Point.

Start Station: is the station on the alignment that corresponds with the starting location or point.

Edit Alignment Screen – General Tab



The General tab in the Edit Alignment screen is used to describe the alignment and select the layer where it is located.

Description: is the description of the alignment.

Layer: is the layer where the alignment will be located.

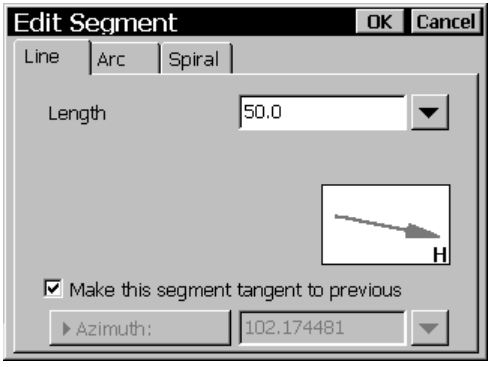
Attributes: accesses the Point Feature Attributes screen (Page R-43) where the feature attributes for the alignment can be selected.

Edit Segment

The Edit Segment screen is accessed anytime an existing horizontal or vertical segment is added or edited. A variety of segment editing screens are possible depending on the type of segment being edited or created. Each segment editor is discussed below.

Edit Segment – Line Card

The Line card is used to add a straight horizontal line segment in the alignment.



Length: is the horizontal length of the line.

☑ **Make this segment tangent to previous**: when checked, the specified line will be tangent to the ending tangent of the previous segment.

Note: When making a new horizontal segment tangent to the previous segment, the new segment will appear in the Edit Alignment screen tagged with a **(P)**. This means that if the previous horizontal segment is edited or deleted, where the orientation changes, all subsequent horizontal segments that have the **(P)** tag will also be adjusted so they will remain tangent to the previous segments.

This does not hold true for vertical alignment segments. Vertical segments will always begin with the specified starting grade unless they are manually modified.

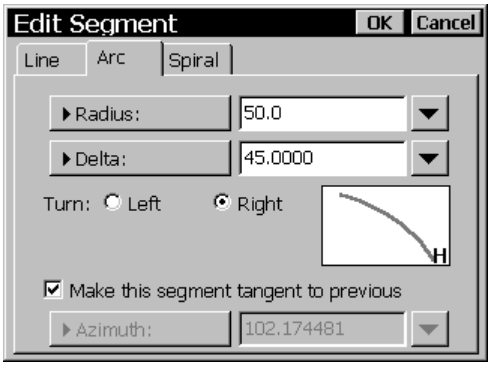
▸Azimuth / ▸Bearing: is used to enter a known azimuth or bearing of the line.

OK: adds the line to the current horizontal alignment.

Edit Segment – Arc (Horizontal Curve) Card

The Arc card is used to add a horizontal curve to the alignment.

The curve can be defined by two of the following:



- Radius: The distance from the radius point to the curve
- Delta: The internal angle from center to tangent points.
- Degree Arc: The internal angle equivalent to a 100-ft arc length.
- Degree Chord: The internal angle equivalent to a 100-ft chord length.
- Length: The arc length.
- Chord : The chord length.
- Tangent: The distance from the PC or PT to the PI.

- Mid Ord: The distance between the curve and the chord at the center of the curve's length.

Turn: specifies if the curve turns to the ⊙ Left or ⊙ Right as you face the curve from the beginning.

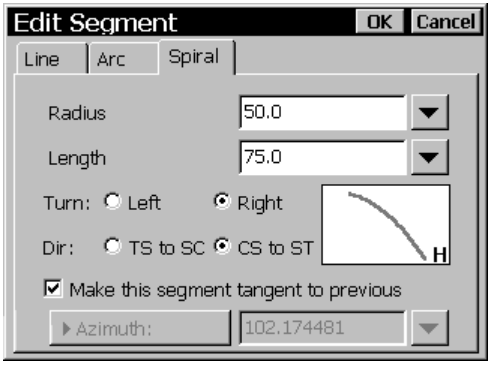
☑ **Make this segment tangent to previous**: when checked, the start of the specified curve will be tangent to the ending tangent of the previous segment.

▸ Azimuth / ▸ Bearing: is used to enter a known azimuth or bearing at the start of the curve.

OK: adds the curve to the current horizontal alignment.

Edit Segment – Spiral Card

The Spiral card is used to add a spiral curve to the alignment.

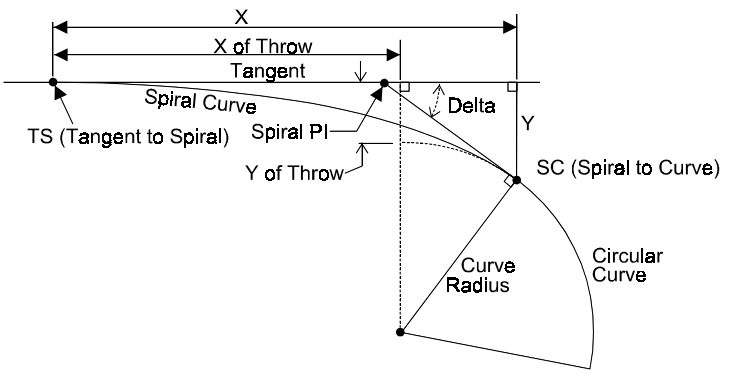


Radius: is the radius of the spiral. (This equals the radius of the horizontal curve tangent to the spiral.)

Length: is the length of the spiral.

Turn: specifies if the curve turns to the ⊙ Left or ⊙ Right as you face the curve from the beginning.

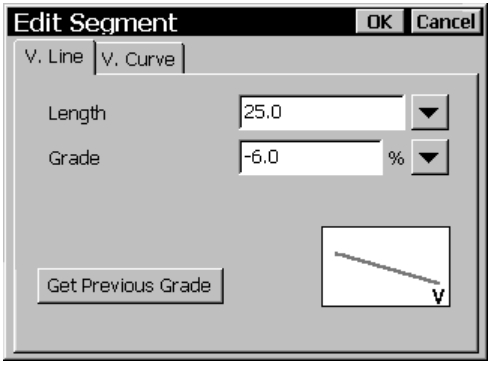
Dir: specifies if the curve runs from ⊙ TS to SC (Tangent to Spiral, to Spiral to Curve) or ⊙ CS to ST (Curve to Spiral, to Spiral to Tangent).



☑ **Make this segment tangent to previous**: when checked, will automatically turn the spiral so the beginning is tangent to the end of the previous segment.

▸ Azimuth / ▸ Bearing: is used to specify a known azimuth or bearing of the start of the spiral.

Edit Segment – Vertical Line Card (Grade)



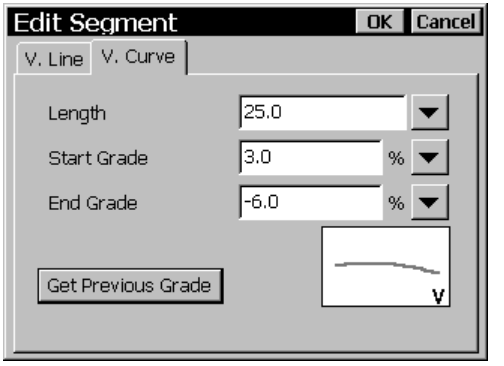
The Vertical Line card is used to enter a segment with any grade.

Length: is the horizontal length of the segment.

Grade: is the grade (slope) of the segment.

Get Previous Grade: will automatically enter a grade equal to the grade at the end of the previous segment.

Edit Segment – Vertical Curve



The Vertical Curve card is used to enter a parabolic vertical curve to the alignment.

Length: is the horizontal length of the vertical curve.

Start Grade: is the starting grade of the vertical curve.

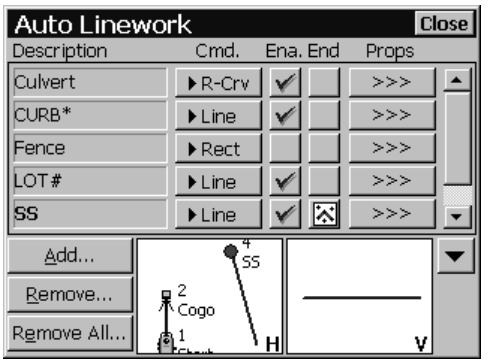
End Grade: is the ending grade of the vertical curve.

Get Previous Grade: will automatically enter a Start Grade equal to the grade at the end of the previous segment.

Auto Linework

2 Job | E Auto Linework or Ctrl-[**L**]

The Auto Linework screen is used to set up custom descriptors that can be used to generate various polylines between points as they are shot. These features can than be exported and used in the TDS ForeSight software.



Note: The auto linework information described below is not written to the raw data file. If using a conversion routine that only uses a raw data file, all linework commands must be manually entered into the raw data file in the form of a note by using the Ctrl-[B] hotkey.

Description: lists the descriptions defined from using the Add... button, which when used during data collection, will generate the specified polyline segment (linework).

The following two wildcards can be appended to a description where each one performs a special function.

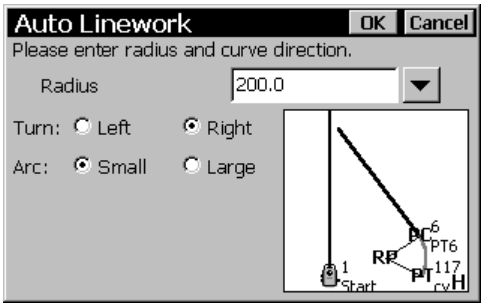
- **Asterisk (*)**: when a description entry ends with an asterisk, any description entered during data collection that begins with the same characters before the asterisk will be joined to the previous linework entry. For example, if CURB* were used as in the screen shown here, and a description for a point was called CURB5 or CURBSIDE, the line segment associated with CURB* would be appended to the previous line segment.
- **Pound sign (#)**: when a description entry ends with a pound sign, any description entered during data collection that begins with the same characters before the pound sign will generate the associated line segment type, but if the next description is at all different from the previous use, a new

independent line segment will be drawn. For example, if LOT# were used as in the screen shown above, all entries of "LOT10" would be connected. If LOT15 were also used as a description during data collection, any future use of LOT15 would connect to the previous LOT15 entry.

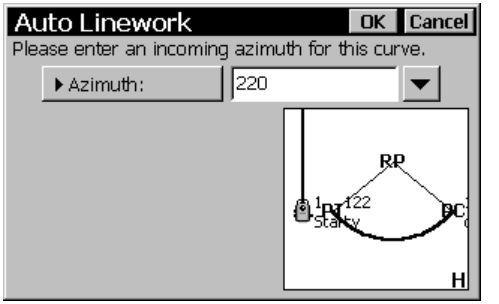
Note: Linework descriptions are case sensitive.

Cmd: lists the current type of line segment (linework) that will be created after shooting the required points and storing them with the associated Description. The following linework command options are selected by repeatedly tapping the appropriate button:

- ▸ Line: creates a straight line between the next two points stored with a description associated with Line.
- ▸ P-Crv: creates a curve through the next 3 points stored with a description associated with P-Crv.
- ▸ R-Crv: creates a curve between the next two points that are stored with a description associated with R-Crv. After the second R-Crv point is shot, the prompt shown will open and is used to define the details of the curve.



- ▸ T-Crv: creates a curve with a specified incoming tangent from the next two points that are stored with a description associated with T-Crv. When the second point is stored, the prompt shown here appears where the incoming azimuth or bearing is specified.



- ▸Rect: will compute and store the fourth and final point that forms a rectangle or parallelogram after three points are stored with a description associated with Rect.

Note: At any time, the line type for any linework command can be changed while collecting linework for a particular feature. For example, a feature called FENCE might primarily use the Line linework command, but might also contain a curved section. To add a curve to the fence, you would use the Ctrl-L hotkey to open the Auto Linework screen and toggle Line to R-Crv prior to storing the first point of the curve. Once the second point of the curve is stored, the curve is defined and appended to the FENCE polyline. This routine is enhanced with the Props command, described below.

☑ **On**: When checked, activates the associated linework command. If a particular polyline is created and then this is unchecked for that linework command, future points stored with the same description would not result in any change to that polyline. But if this is then activated again later, all future points collected using the same linework command will be appended to the original polyline.

End: toggles between the following two functions, giving you control in collecting data for two or more separate features that use the same linework command:

 When the map icon is displayed for this button, a polyline has been created for the associated linework command. Tapping the button will then allow you to detach future points using this linework command from the current polyline, resulting in future points being added to a new polyline.

 If the button is blank and the current job contains at least one polyline, you will be prompted to select an existing polyline. Once selected, future points stored with this linework command will be appended to the selected polyline.

Props: A single polyline can contain different line types. The Props command will open the Auto Linework Properties dialog box, shown here, where when the checkbox is checked, the linework command will always switch back to

the specified default linework command after changing and storing a different line type for a particular feature.

Add... : allows you to create a new linework command.

Remove... : removes the selected linework command.

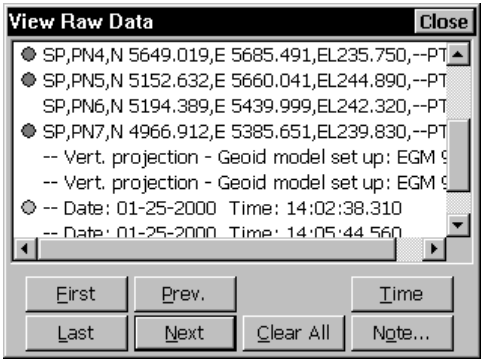
Remove All... : removes all the existing linework commands.

Note: All linework shots require at least two points with a particular linework command before a polyline segment is created. If only the initial point has been stored, no polyline segment is yet created.

View Raw Data File

2 Job | F View Raw Data

The View Raw Data File screen displays the raw data file of the current job and allows you to append a note or current time entry.



Tapping any line in the raw data file will toggle a bookmark in front of that line. The active bookmark is shown as a green (or light-gray) circle. An inactive bookmark is shown in red (or dark gray). See illustration.

First : jumps to the first line of the file.

Last : jumps to the last line of the file.

Prev. : jumps to bookmark above the active bookmark.

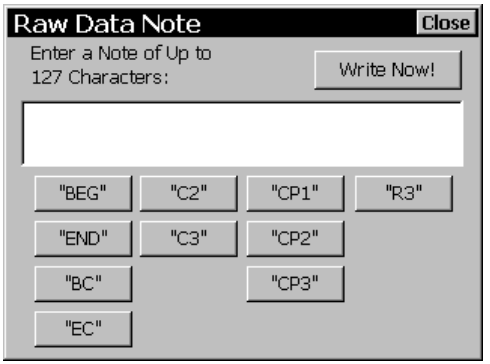
Next : jumps to the bookmark below the active bookmark.

Clear All : clears all bookmarks.

Time : appends the current date and time in the form of a note to the end of the raw data file.

Note... : opens the Raw Data Note screen where any note, up to 127 characters, can be appended to the raw data file.

Raw Data Note



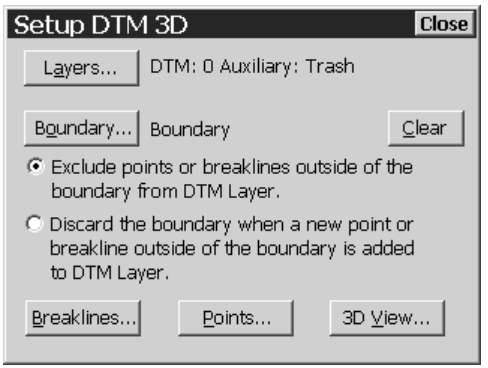
Enter any note to append to the raw data file. You can use the buttons to insert common line work commands.

When finished, tap Write Now! to append the note to the end of the raw data file.

View DTM

2 Job | G View DTM

Before viewing a DTM, the Setup DTM 3D screen will open where the DTM layers must be defined. This screen is also used to define other parameters for the DTM.



Layers: opens the Layers for Staking DTM screen where the DTM layers are selected.

Boundary: opens the Choose Polyline screen where a polyline can be selected that defines the boundary of the DTM.

Exclude points...: will move any points that exist outside the selected boundary to the Auxiliary layer. If a point is later stored outside the boundary, they will also be moved to the Auxiliary layer.

Discard the boundary...: will initially move any points that exist outside the boundary to the Auxiliary layer. If a point is later stored outside the boundary, the selected boundary is automatically unselected.

Clear: will unselect the selected boundary and move it to the Auxiliary layer.

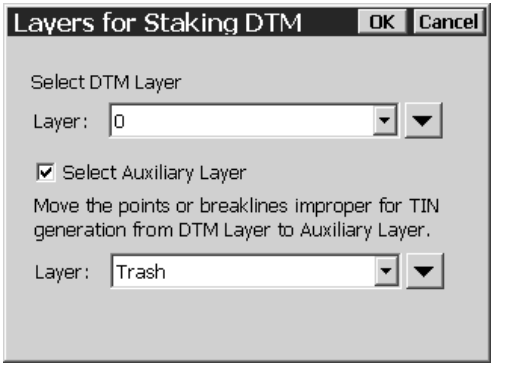
Breaklines...: will open the Add/Edit Break-lines screen where DTM break-lines can be added or edited.

Points...: will open the Points on DTM Layer screen where the points on the DTM layer can be viewed, new points can be imported, and existing points can be deleted (moved to the Auxiliary layer).

3D View...: will open the 3D View screen where the DTM can be viewed from any angle.

Layers for Staking DTM

2 Job | G View DTM | Layers...



The Layers for Staking DTM screen is used to select the DTM layer and an optional layer where non-DTM points will be stored.

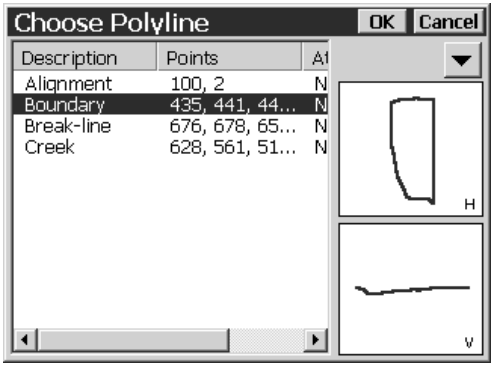
Layer (DTM): is the layer that contains the points that you want to use for the DTM.

Select Auxiliary Layer: if this is checked and a point is stored that is located outside the selected DTM boundary, the point is automatically stored on the Auxiliary layer. If left unchecked, a prompt will appear when storing a point outside the boundary where you must specify the layer to store the new point.

Layer (Auxiliary): is the layer that all points will be stored to if they cannot be stored to the DTM layer.

Choose Polyline

2 Job | G View DTM | Boundary...



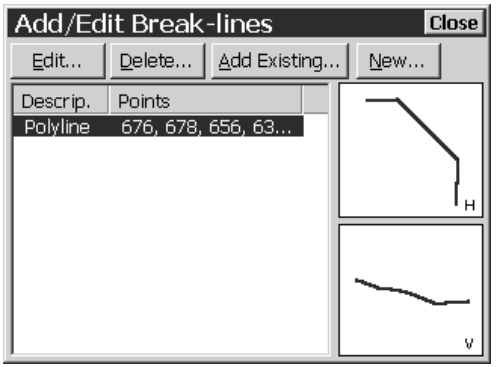
The Choose Polyline screen is used to select an existing polyline.

All the polylines in the current job are displayed. Select the appropriate polyline and tap OK.

Add/Edit Break-lines

2 Job | G View DTM | Break-lines...

The Add/Edit Break-lines screen is used to select, edit, create, or delete the break-lines that will be used when computing the DTM. The break-lines that will be used when computing the DTM are listed in this screen.



Edit...: opens the Edit Polyline screen where the selected polyline can be modified or a new polyline can be created.

Delete...: will move the selected polyline to the Auxiliary layer.

Add Existing...: will display all the polylines in the current job. Selecting a polyline and tapping OK will move the selected polyline to the DTM layer.

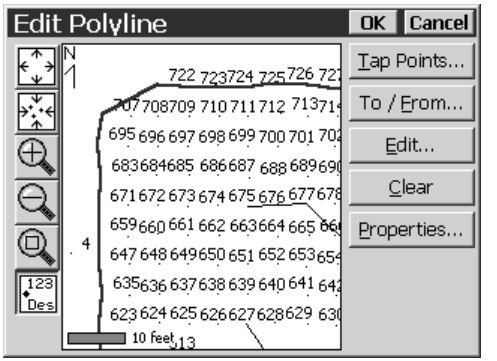
Note: If a boundary is defined, only polylines that fall within the boundary can be added.

New... : opens the New Polyline screen, which is identical to the Edit Polyline screen and is used to create a new polyline.

Edit Polyline

2 Job | G View DTM | Break-lines... | Edit... or

2 Job | G View DTM | Break-lines... | New...



The Edit Polyline screen is used to perform some preliminary editing to a polyline prior to accessing the polyline editor with the Edit... key.

Tap Points... : allows you to tap points to define a new polyline. If a polyline was already selected prior to accessing this screen, it will be replaced by the polyline being created.

To / From... : allows you to define a range of points that define a polyline. If a polyline was already selected prior to accessing this screen, it will be replaced by the polyline being created.

Edit... : accesses the Polyline Editor, described on Page R-45, where the polyline can be further edited.

Clear : will permanently remove the selected polyline from the job.

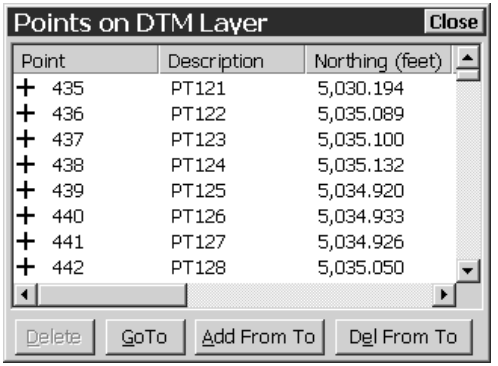
Properties... : opens the New Line dialog box where the description, layer and feature attributes can be modified.

123 Des : opens the Map Display Options screen (Page R-233) to select what is displayed on the screen.

Points on DTM Layer

2 Job | G View DTM | Points...

The Points on DTM Layer screen displays all the points on the DTM layer and allows you to add points from another layer or delete (move) points to a different layer.



Delete: will move the selected point(s) to the Auxiliary layer. If the Auxiliary layer is not specified, you will be prompted to select the layer to move the points to.

Note: Points on a boundary or break-line cannot be deleted.

GoTo: will quickly find and select the specified point.

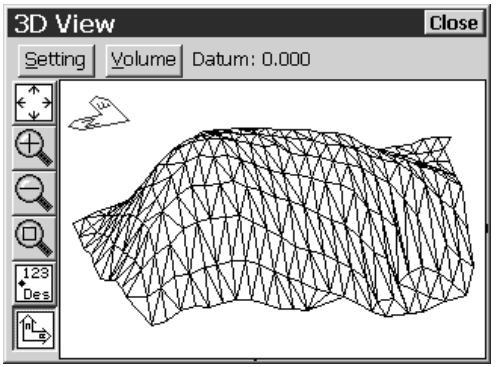
Add From To: opens the Select Point(s) screen where a point range can be entered. The points will then be moved to the DTM layer.

Del From To: opens the Select Point(s) screen where a point range can be entered. The points will then be moved to the Auxiliary layer.

3D View

2 Job | G View DTM | 3D View...

The 3D View screen is used to view the DTM from any angle.



Setting: opens the 3D View Settings screen, described below, where the information displayed in the 3D view can be configured.

Volume: displays the total cut and fill volume between the area that has been staked and a reference datum, whose elevation is specified in the 3D View Settings screen; or the total cut and fill between the area that has been staked and the selected DTM.

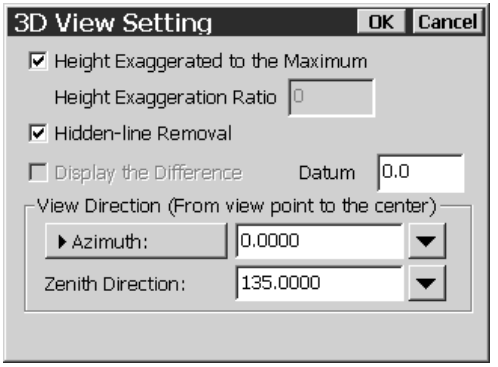
Datum: displays the datum elevation set in the 3D View Settings screen.

123 Des: Toggles to display or hide the point names and descriptions.

: When this button is activated (pressed in), dragging within the 3D View will result in the image being rotated to any angle. When the button is not activated, dragging within the 3D View will move the image to any location.

3D View Settings

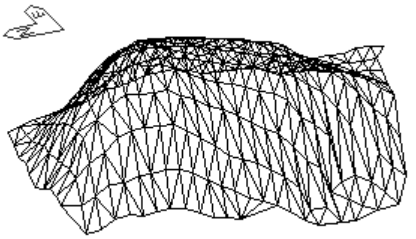
2 Job | G View DTM | 3D View... | Setting



The 3D View Settings screen is used to configure the information displayed in the 3D View screen.

☑ **Height Exaggerated to the Maximum**: When checked, the height exaggeration is automatically set to a high value. When unchecked, the height exaggeration can be set manually in the next field.

Height Exaggeration Ratio: is the value that the height is multiplied by in the 3D view. The higher this value, the more exaggeration, where 1.0 would result in no exaggeration.



☑ **Hidden-line Removal**: When checked, will hide all the lines that occur behind other surfaces in the 3D View. The image shown here is identical to the image shown on Page R-64 except the hidden lines are not removed.

☑ **Display the Difference**: This applies only to DTM stakeout. When checked, the elevations in the 3D View screen will be distorted so the reference DTM will become a flat surface. This will result in any staked point that occurs above or below the reference DTM to stand out as hills and valleys.

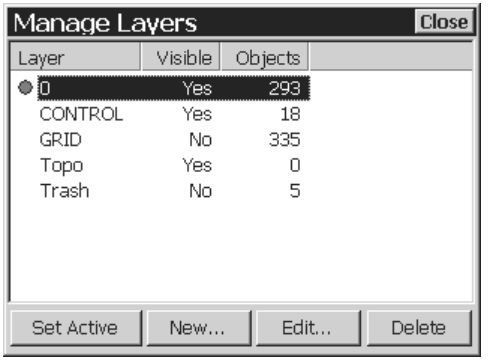
Datum: When the Display the Difference checkbox is unchecked, cut and fill volumes will be computed in the 3D View screen based on the difference of a horizontal plane at the elevation specified here and the staked points.

View Direction (from view point to the center): allows you to specify the exact horizontal and vertical angle in which to view the DTM.

Manage Layers

2 Job | H Manage Layers or Ctrl - [**K**]

The Manage Layers screen is used to manage the layers for the current job. All existing layers are displayed along with which layers are visible and how many objects are on each layer.



Set Active: will set the selected layer as the active layer. The active layer is marked with a ● symbol.

New...: opens the New Layer dialog box where a new layer can be added. You are prompted for a name and if the new layer should be visible.

Edit...: opens the Edit Layer dialog box where the selected layer can be edited. The layer name and visibility can be changed.

Delete: will delete the selected layer.

Note: Only layers that contain no objects can be deleted. Layer 0 is required and cannot be deleted or renamed.

Tip: To move several points from one layer to another, select the desired points in the Edit Points screen (Page R-38) and tap Edit. Select the layer you want to move them to and tap OK.

Job Information

2 Job | I Job Info

The Job Information screen displays details of the current job and allows you to remove wasted space in the current job file.

Filename: displays the current job file name.

Control file: displays the control filename used in the current job.

Feature Code File: displays the feature code filename used in the current job.

Folder: displays the directory where the current job file is located.

Size: displays the size of the current job.

Created: displays the date that the current job was created.

Points: displays the first and last point names and if alphanumeric point names are being used.

Lines: displays the number of polylines and alignments that are in the current job.

Roads: displays the number of roads in the current job and the filenames associated with them.

Attributes Collected: displays the number of point and line attributes used in the current project.

Total Storage: displays the total amount of memory that is installed on the data collector.

Available Storage: displays the amount of free memory that is available to use for jobs.

Wasted Space: displays the amount of empty space that is being used by the current job. This space can be recovered as described below.

Recover Wasted Space Now: As you add and remove points and lines in a job, empty gaps can result within the job file. These gaps use

storage space. This button will remove any gaps in the job file, thus recovering the wasted space.

Note: Survey Pro checks for low memory situations every minute. When the available system memory falls below 256K of RAM, a warning is displayed.

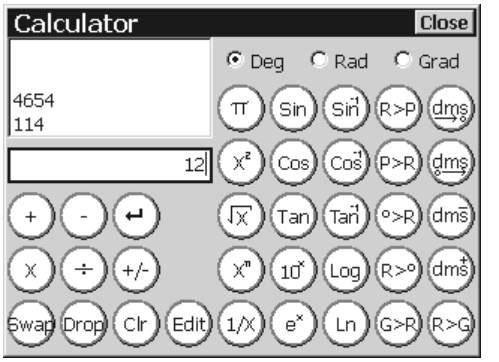
Calculator

2 Job | J Calculator or

Ctrl - [**A**] or

▼, Calculator (where applicable)

The Calculator screen behaves exactly like any other RPN-format calculator. It consists of a stack that can contain any number of values and buttons that perform various operations. When a value is being entered from the keypad, it is displayed in a special area called the active area. This value is then place in Level 1 of the stack after tapping the Enter key.



Tapping a button on the display performs the corresponding operation on either the last value in the display, or the last two values, depending on the operation. Each button is explained below where the value in Level 1 is *x* and the value in Level 2 is *y*.

+: Adds *x* and *y*.

×: Multiplies *x* and *y*.

Swp: Swaps positions of *x* and *y* in the stack.

–: Subtracts *y* from *x*.

÷: Divides *y* by *x*.

Drp: Drops (removes) *x* from the stack.

↵: Moves the active value to Level 1 of the stack, or duplicates Level 1 if there is no active value.

±: Changes the sign of *x*.

Clr: Clears the stack.

Edit: Moves the value in Level 1 to the active area where it can be edited.

π: Enters 3.141592654 to the stack.

x^2: Squares *x*.

√x: Square root of *x*.

x^n: Raises y to the power of *x*.

1/x: Inverse of *x*.

Sin: Sine of *x*.

Cos: Cosine of *x*.

Tan: Tangent of *x*.

10^x: Raises 10 to the power of *x*.

e^x: Raises 2.718281828 to the power of *x*.

Sin^{-1}: Arc sine of *x*.

Cos^{-1}: Arc cosine of *x*.

Tan^{-1}: Arc tangent of *x*.

Log: Common logarithm (base 10) of *x*.

Ln: Natural logarithm (base e) of *x*.

R>P: Converts the rectangular coordinates (*y*,*x*) to polar coordinates.

P>R: Converts the polar coordinates (*y*,*x*) to rectangular coordinates.

°>R: Converts *x*, in decimal degrees to radians.

R>°: Converts *x*, in radians to decimal degrees.

G>R: Converts *x*, in Grads to radians.

dms→°: Converts *x*, in degrees.minutes-seconds to decimal degrees.

°→dms: Converts *x* in decimal degrees to degrees.minutes-seconds.

dms –: Subtracts *x* in degrees.minutes-seconds from *y* in degrees.minutes-seconds.

dms +: Adds *x* in degrees.minutes-seconds and *y* in degrees.minutes-seconds.

R>G: Converts *x*, in radians to Grads.

Survey Menu

The Survey Menu contains the routines used for collecting data.

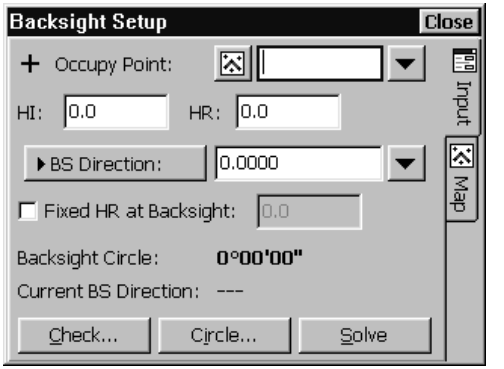
A: Backsight Setup
B: Traverse / Sideshot
C: Repetition Shots
D: Multiple Sideshots
E: Distance Offset
F: Horizontal Angle Offset
G: Vertical Angle Offset
H: Corner & 2 Lines
I: Corner & Angle
J: Corner & Offset
K: Corner & Plane
L: Shoot From Two Ends
M: Record Mode
N: Resection
O: Remote Elevation
P: Solar Observation
Q: Remote Control

Backsight Setup

3 Survey | A Backsight Setup

The Backsight Setup screen allows you to define your backsight prior to performing data collection or stakeout. The screen is also accessible from any screen that requires a backsight.

Note: all the information in the Backsight Setup screen is saved so it will automatically be recalled if the job is reopened at a later time. Although the information is saved, the screen must still be re-solved before you can survey.



Occupy Point: is the name of the point from the current job that the total station is occupying.

HI: is the height that the total station is above the ground.

HR: is the distance that the backsight prism is above the ground.

BS Point / BS Direction: is the point or direction of the backsight where the total station is facing.

Fixed HR at Backsight: is selected when a second prism is set up over the backsight. The rod height entered here is then used independently of the other rod height when checking the backsight by distance and when shooting the backsight during repetition shots.

Backsight Circle: displays the backsight circle value, which is set using the Backsight Circle button, described below.

Note: The backsight circle angle is subtracted from all horizontal angles that are read during data collection and the resulting points are adjusted accordingly. If you do not want this to happen, you should change the value to zero by using the Backsight Circle button.

Current BS Direction: displays the azimuth of the current backsight.

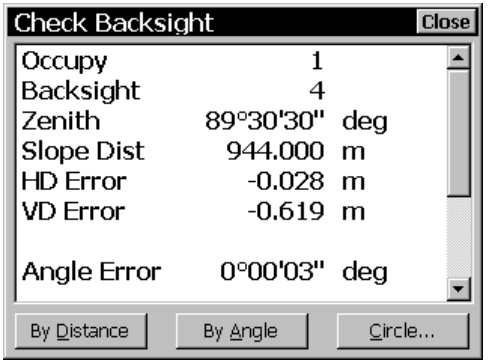
Check... : accesses the Check Backsight dialog box (Page R-73), which is used to help confirm that the total station is facing the correct backsight.

Circle... : accesses the Backsight Circle dialog box (Page R-74) where the backsight circle can be changed, or the circle reading on the total station can be set remotely.

Solve : solves the screen based on the information entered and automatically displays the map view showing the location and direction of the current backsight.

Check Backsight Dialog Box

The Check Backsight screen is used to help confirm that the total station is facing the correct backsight by comparing the known distance or circular angle to the backsight with the measured value.



By Distance : will take a shot to a prism located over the backsight point and compare the measured distance with the computed distance between the occupy and backsight points stored in the current job.

Note: The Check by Distance method does not apply if the backsight is defined by a direction.

By Angle : when the backsight is defined by a direction, this routine will read the current horizontal angle from the total station and compare that to the backsight direction.

Circle... : accesses the Backsight Circle dialog box, described below.

Check by Distance Results

Occupy: is the current occupy point.

Backsight: is the current backsight point.

Zenith: is the zenith angle measured by the total station.

Slope Dist: is the slope distance measured by the total station.

HD Error: is the horizontal distance between the backsight point that was shot and the backsight point stored in the job. A negative value indicates that the point shot is closer to the total station than the point in the job.

VD Error: is the vertical distance between the backsight point that was shot and the backsight point stored in the job.

Check by Angle Results

Circle: is the horizontal angle that was measured by the total station.

Azimuth: is the known azimuth to the current backsight.

Error: is the difference between the two above angles.

Backsight Circle Dialog Box

The Backsight Circle dialog box is used to modify the horizontal angle read from a total station so that the resulting angle is an azimuth.

Backsight Circle: is the angle that will be subtracted from all horizontal angles read from the total station or entered manually when data collecting in manual mode.

Set: Sets the value entered in the Backsight Circle field as the backsight circle and returns to the previous screen.

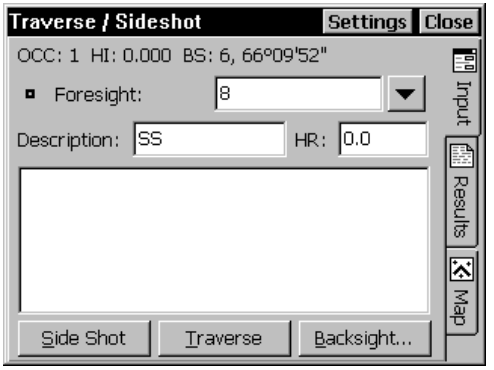
Note: Closing this dialog box without tapping the Set button will result in no changes made to the original backsight circle.

Read from Instrument: Reads the current horizontal angle from the total station and puts that value in the Backsight Circle field where it can then be Set as the backsight circle. This is typically performed when it is known that the total station is facing a direction with a zero azimuth.

Traverse / Sideshot

3 Survey B Traverse / Sideshot

The Traverse / Sideshot screen is the main screen used for data collection.



Settings: located at the top of the screen, is a shortcut to the Surveying Settings screen (Page R-33).

Foresight: is the point name that will be used for the next stored point.

Description: is the description for the next stored point.

HR: is the height of the rod.

Side Shot: will trigger the total station to take a shot to the prism. The new point is stored as a side shot in the data collector and the foresight point will automatically advance to the next available point.

Traverse: will trigger the total station to take a shot to the prism. The new point is stored as a traverse shot in the data collector and a The Traverse Now or Later dialog box will open, described on Page R-77. If you choose to traverse now, the occupy point will automatically change to the previous foresight point and the backsight point will automatically change to the previous occupy point.

Note: prior to storing a point, you may then be prompted for description, rod height, layer, and/or feature information depending on the selections made in the Surveying Settings screen.

Backsight... : accesses the Backsight Setup screen (Page R-72) where the current backsight can be modified.

Note: The current backsight information is displayed across the top of the Traverse / Sideshot screen.

Results

Angle Right: is the horizontal angle right around the Occupy Point from the Backsight to the Foresight Point.

Azimuth: is the azimuth from the Occupy Point to the Foresight Point.

Zenith: is the zenith angle measured by the total station to the prism.

Slope Dist: is the slope distance measured by the total station to the prism.

Hor. dist: is the horizontal distance from the Occupy Point to the Foresight Point.

Vert. dist: is the vertical distance from the Occupy Point to the Foresight Point.

Point: is the name of the stored point.

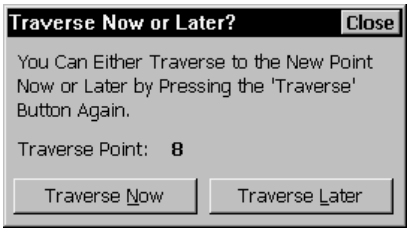
Desc: is the description of the stored point.

Location N: is the Y-coordinate of the stored point.

Location E: is the X-coordinate of the stored point.

Location Z: is the elevation of the stored point.

Traverse Now or Later? Dialog Box



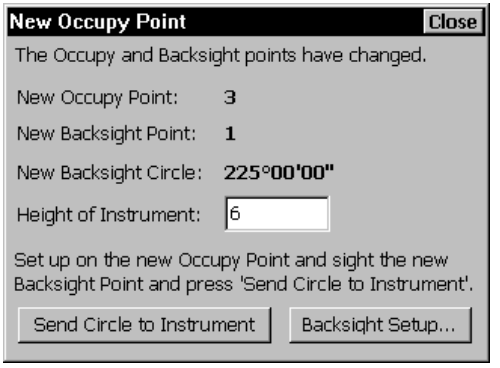
After taking a shot with the Traverse button, the Traverse Now or Later? dialog box will open where you can specify if you want to traverse now or later .

Traverse Now: expects you to move your total station to the next occupy point before any additional shots are taken. The occupy, foresight, and backsight points will be updated accordingly.

Traverse Later: allows you to take additional side shots before moving the total station to the next traverse point. This is useful is you want to take side shots from the current occupy point, but perform the traverse shot as the first shot of the current set up to ensure the highest accuracy.

When you have finished taking side shots, tap the Traverse button again. You can then select Traverse Now and set up on the next occupy point, or select Shoot New Traverse to re-shoot the traverse shot.

New Occupy Point Dialog Box



After traversing to a new point, the New Occupy Point dialog box will open that informs you of the points that have been updated and computes the azimuth to the new backsight.

New Backsight Circle: displays the horizontal angle that should be displayed on the total station once it is set up over the New Occupy Point and facing the New Backsight Point. This angle is typically zero unless you are surveying in true azimuths, as set in the Surveying Settings screen (Page R-33).

Height of Instrument: is the new height that the total station is above the ground.

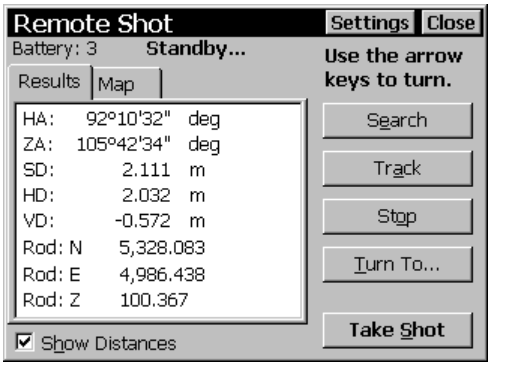
Send Circle to Instrument: can be used once the instrument has been moved to the New Occupy Point and is aiming toward the New Backsight Point. The New Backsight Circle angle will then be sent to the total station so its horizontal angle will display this value.

Backsight Setup: accesses the Backsight Setup screen (Page R-72) where the current backsight can be modified.

Remote Shot Screen (Remote Mode)

3 Survey | B Traverse / Sideshot | Traverse or Side Shot

When running in remote mode, tapping the Traverse or Side Shot button from the Traverse / Sideshot screen will open the Remote Shot screen, shown here.



The Remote Shot screen is identical to the Remote Control screen (Page R-100), except it has an additional button that allows you to trigger the total station to take a shot.

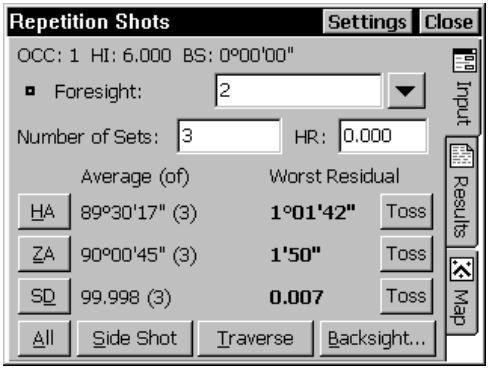
Take Shot: after the total station is properly aiming toward the prism, this will trigger the total station to take a shot. If you are performing a side shot, you will remain in the Remote Shot screen once the shot is completed. If you are performing a traverse shot, you will return to the Traverse / Sideshot screen when the shot is completed.

Repetition Shots

3 Survey | C Repetition Shots

The Repetition Shots screen is used to perform side shots or traverse shots using any number of repetitions.

Note: The sequence that the repetition shots are performed is selected in the Repetition Settings screen (Page R-36).



Settings: located at the top of the screen, is a shortcut to the Surveying and Repetition Settings screens (Page R-33 and R-36 respectively).

Foresight: is the name of the point that will be stored.

Number of Sets: is the desired number of sets to shoot to the backsight and foresight.

Note: One set is equivalent to two shots to the backsight and foresight point.

HR: is the rod height.

Average (of): shows the average angle or distance to the foresight from all the shots taken. The value in parenthesis is the total number of repetitions performed.

Worst Residual: displays the worst residual calculated from all the sets of the selected measurement type.

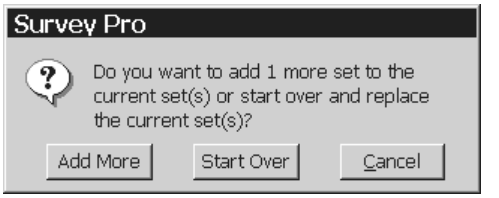
Description: is the description for the point that is being stored. This field appears prior to storing the new point.

Note: A residual is the difference between a single measurement and the average of all the measurements.

Note: If a residual exceeds the tolerances set in the Repetition Settings screen (Page R-36), that value is displayed in **bold** text.

HA, ZA, SD: allows you to replace the current repetition data for the corresponding button with new data. Once tapped, the repetition data for the tapped button will be deleted. You will then need to perform all sets defined in the Number of Sets field again, where the new data will replace the corresponding deleted data.

All: will open the prompt shown here where you can either select to add an additional set to those already done, or start over.



Toss: will delete the corresponding set that has the worst residual.

Note: A set can only be "tossed" when three or more sets have been collected.

Side Shot: will use the repetition data gathered to create a new side shot point. The foresight point will automatically advance to the next available point.

Traverse: will use the repetition data gathered to create a new traverse point. The occupy point will automatically update to the previous foresight point and the backsight point will automatically update to the previous occupy point.

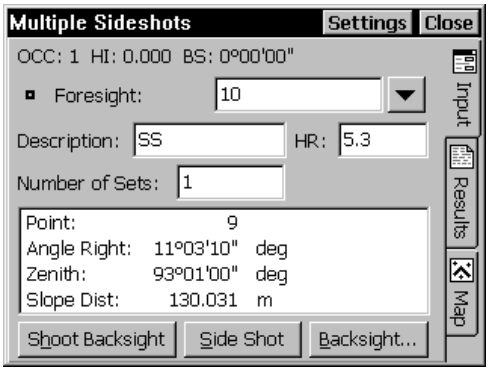
Backsight...: accesses the Backsight Setup screen (Page R-72) where the current backsight can be modified.

Note: The current backsight information is displayed across the top of the Repetition Shots screen.

Multiple Sideshots

3 Survey | D Multiple Sideshots

The Multiple Sideshots screen is used to perform multiple side shots using any number of repetitions to each foresight without the need to re-shoot the backsight.



Foresight: is the point name that will be stored.

Description: is the description for the next stored point.

HR: is the length of the rod.

Number of Sets: is the desired number of sets to shoot to the backsight or foresight.

Settings: located at the top of the screen, is a shortcut to the Surveying and Repetition Settings screens (Page R-33 and R-36 respectively).

Shoot Backsight: is used to shoot the backsight. You will be required to shoot the number of sets to the backsight entered in the Number of Sets field.

Note: The backsight can be re-shot at any time, but it must be shot before the first side shot can be shot.

Side Shot: is used to shoot a side shot. Once the final set is complete, the new point is stored and the foresight point will automatically advance to the next available point.

Backsight...: accesses the Backsight Setup screen (Page R-72) where the current backsight can be modified.

Distance Offset Shot

3 Survey | E Distance Offset

The Distance Offset screen is used to store a new point that is a known distance away from the rod location. This screen is useful when the rod cannot occupy the new point's location.

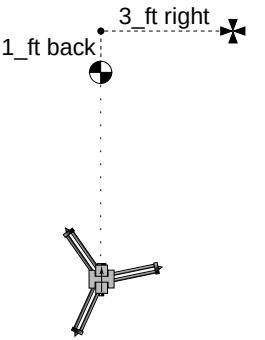
Settings: located at the top of the screen, is a shortcut to the Surveying Settings screens (Page R-33).

Foresight: is the point name that will be stored.

Description: is the description for the offset shot that is stored.

HR: is the length of the rod.

Offset: is the offset distance that is to the left (when ⊙L is selected) or right (when ⊙R is selected) of the prism from the total station's point of view.



Horz Dist Offset: is the offset distance that is beyond the prism (positive value) or in front of the prism (negative value) from the total station's point of view.

Elevation Offset: is the offset distance that is below the prism (negative value) or above the prism (positive value).

Note: multiple offsets can be applied simultaneously.

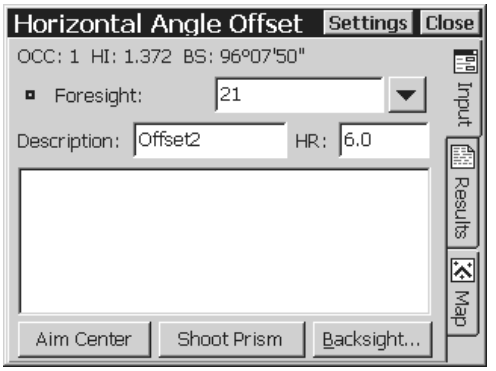
Shoot: will take a shot to the prism, apply the offset(s) entered, and then store the new point.

Backsight...: accesses the Backsight Setup screen (Page R-72) where the current backsight can be modified.

Horizontal Angle Offset

3 Survey | F Horizontal Angle Offset

The Horizontal Angle Offset screen allows you to compute and store the location of a new point that cannot be occupied, such as at the center of large tree.

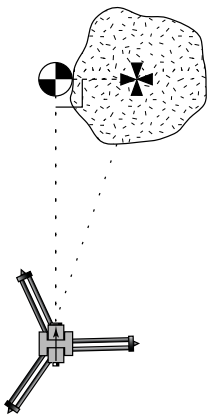


The routine shoots a prism positioned at the side of the new point and then reads the horizontal angle when aiming toward the center of the new point to compute the new point's location.

Settings: located at the top of the screen, is a shortcut to the Surveying Settings screen (Page R-33).

Foresight: is the point name that will be used when storing the new point.

Aim Center: will record the horizontal angle from the total station, which should be facing the center of the new point.



Shoot Prism: will take a shot to the prism, which is located at the side of the new point.

Backsight...: accesses the Backsight Setup screen (Page R-72).

Note: The new point will have the same elevation as the point occupied by the prism.

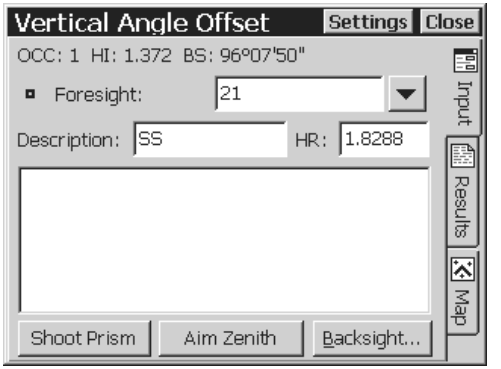
Note: The prism only needs to occupy the location at the side of the new point. A prism is not necessary when shooting the location directly in front of the new point.

Vertical Angle Offset

3 Survey | G Vertical Angle Offset

The Vertical Angle Offset screen allows you to compute and store the location of a new point that exists directly above or below the rod location, but cannot be occupied, such as the top of a utility pole.

The new point will have the same coordinates as the rod location, but with a different elevation.



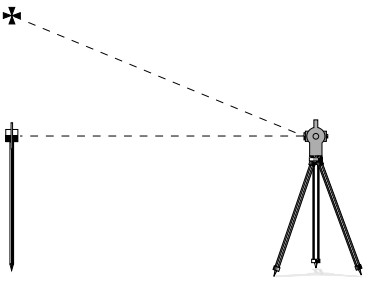
Settings: located at the top of the screen, is a shortcut to the Surveying Settings screen (Page R-33).

Foresight: is the point name that will be used when storing the new point.

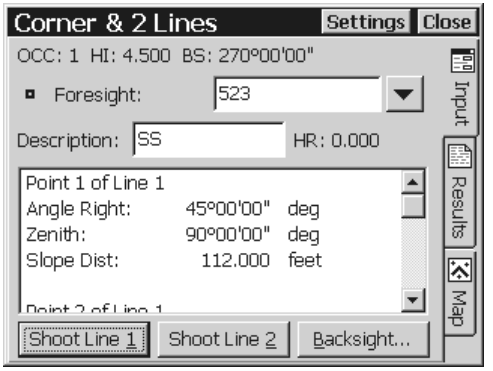
Shoot Prism: will take a shot to the prism.

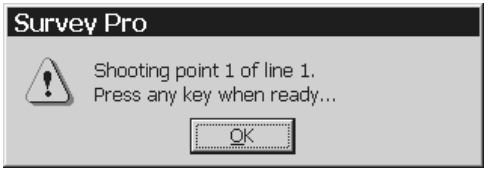
Aim Zenith: will read the vertical angle measured by the total station, which should be facing the new point's location.

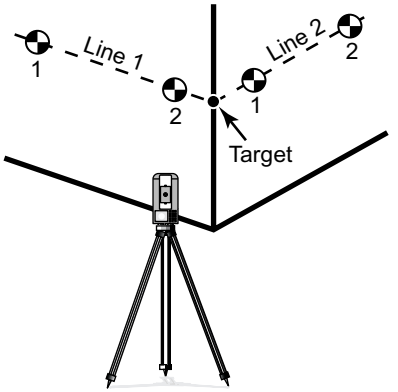
Backsight...: accesses the Backsight Setup screen (Page R-72).



Corner & 2 Lines







Corner & 2 Lines

[3] Survey [H] Corner & 2 Lines

The Corner and 2 Lines screen is used to store a point at the corner of a structure using a reflectorless total station where a direct measurement to the point is not possible, but two points on two intersecting lines can be shot.

Foresight: is the name of the point that will be stored.

Description: is the description for the point that will be stored.

HR: 0.000: shows that no rod height will be used with this routine since all shots are direct reflectorless.

[Shoot Line 1]: will prompt you to take two shots on Line 1, which intersects with Line 2 at the point you want to store.

Note: Each shot for a line can be in any location on the same line. (Shot 1 can be to the left or the right of Shot 2.)

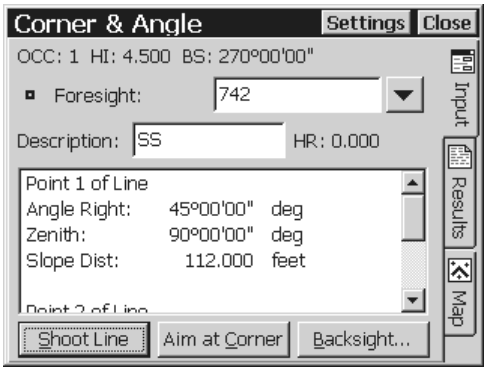
[Shoot Line 2]: will prompt you to take two shots on Line 2, which intersects with Line 1 at the point you want to store.

Note: After all shots are done, the computed elevation is displayed for the new point. You can either enter a different elevation or tap [OK] to accept the computed elevation.

[Backsight]: accesses the Backsight Setup screen (Page R-72) where the current backsight can be modified.

Corner & Angle

3 Survey | I Corner & Angle



The Corner and Angle screen is used to store a point that cannot be shot on a reference line using a reflectorless total station where two other points on the same line can be shot.

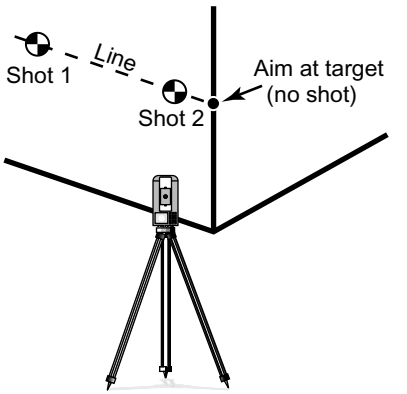
Foresight: is the name of the point that will be stored.

Description: is the description for the point that will be stored.

HR: 0.000: shows that no rod height will be used with this routine since all shots are direct reflectorless.

Shoot Line: will prompt you to take two shots on a line that intersects with the point you want to store.

Note: Each shot can be in any location on the line. (Shot 1 can be to the left or the right of Shot 2.)



Corner & Angle

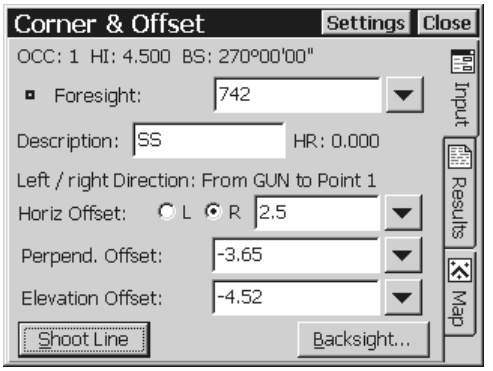
Aim at Corner: will prompt you to aim at the corner (the point that you want to store). Although no shot is taken, the angles to the point will be used to compute its location.

Note: After all shots are done, the computed elevation is displayed for the new point. You can either enter a different elevation or tap OK to accept the computed elevation.

Backsight: accesses the Backsight Setup screen (Page R-72) where the current backsight can be modified.

Corner & Offset

[3] Survey [J] Corner & Offset

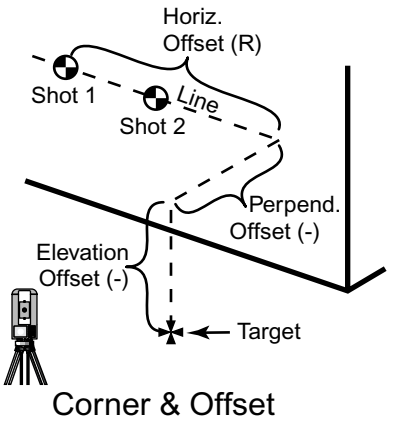


The Corner and Offset screen is used to store a point using a reflectorless total station for a point that cannot be shot directly, but the offset(s) to the point can be measured from a reference line that can be shot.

Foresight: is the name of the point that will be stored.

Description: is the description for the point that will be stored.

HR: 0.000: shows that no rod height will be used with this routine since all shots are direct reflectorless.



Corner & Offset

Horiz Offset: is the horizontal distance on the line from Shot 1 to the new point. Select ⊙L if the new point falls to the left of Shot 1, or select ⊙R if it falls to the right.

Perpendicular Offset: is the horizontal distance, perpendicular to the reference line, from the line to the new point (see diagram). A positive value extends away from the total station where a negative value is closer to the total station.

Elevation Offset: is the vertical offset from the line to the new point. (See diagram.) A positive value will result in a new point above the reference line and a negative value results in a new point below the reference line.

Shoot Line: will prompt you to take two shots on the horizontal reference line.

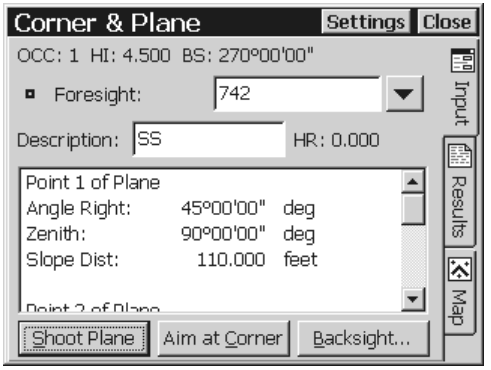
Note: Each shot can be in any location on the reference line (Shot 1 can be to the left or the right of Shot 2), but the Horiz Offset is always measured from Shot 1.

Backsight: accesses the Backsight Setup screen (Page R-72) where the current backsight can be modified.

Note: After each shot is complete, the computed elevation is displayed for the new point. You can either enter a different elevation or tap OK to accept the computed elevation.

Corner & Plane

3 Survey K Corner & Plane



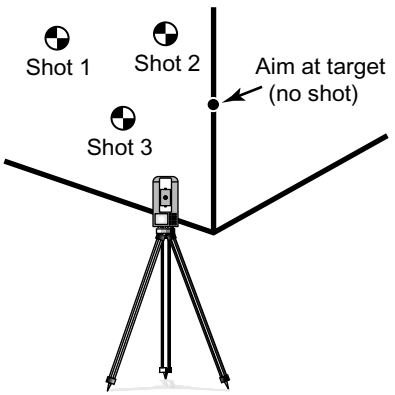
The Corner and Plane screen is used to store a point using a reflectorless total station for a point that cannot be shot, but three points on the same plane can be shot.

Foresight: is the name of the point that will be stored.

Description: is the description for the point that will be stored.

HR: 0.000: shows that no rod height will be used with this routine since all shots are direct reflectorless.

Shoot Plane: will prompt you to take three shots on the same flat surface that the new point is located.



Corner & Plane

Note: Each shot can be in any location on the same plane, but they must not form a straight line and they should not be grouped close together.

Aim at Corner: will prompt you to aim at the corner (the point that you want to store). Although no shot is taken, the angles to the point will be used to compute its location.

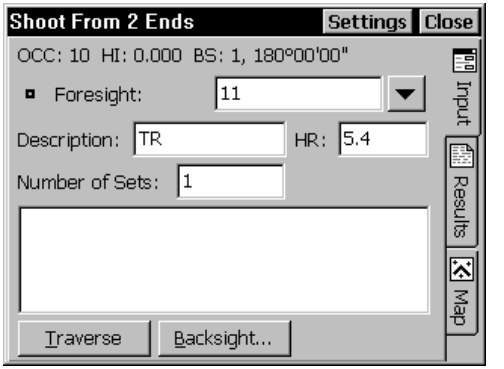
Note: After all shots are done, the computed elevation is displayed for the new point. You can either enter a different elevation or tap OK to accept the computed elevation.

Backsight: accesses the Backsight Setup screen (Page R-72) where the current backsight can be modified.

Shoot From Two Ends

3 Survey | L Shoot From 2 Ends

The Shoot From 2 Ends screen is used to provide more accurate vertical closure to a traverse. The routine requires that a foresight point is shot, but it is not stored until after it is occupied and another shot is taken to the previous occupy point. The coordinates for the foresight point are computed from an average of data gathered at each occupy point.



Settings: located at the top of the screen, is a shortcut to the Surveying and Repetition Settings screens (Page R-33 and R-36 respectively).

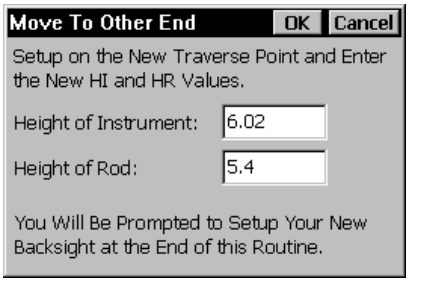
Foresight: is the name given to the next stored point.

Description: is the description given to the next stored point.

HR: is the length of the rod.

Number of Sets: is the desired number of sets required when shooting each foresight. You must select at least one set.

Traverse: will prompt you to shoot the Foresight point. After each set is performed, the Move To Other End dialog box will open (shown here) and prompt you to set up on the new point and enter a new instrument and rod height. The New Occupy Point dialog box (Page R-77) will open and inform you of the updated points.



BS Setup...: accesses the Backsight Setup screen (Page R-72) where the current backsight can be modified.

Record Mode

3 Survey | M Record Mode

When running in Record Mode, all control of the total station is performed from the total station's keypad. The data collector will simply log each shot that is taken from the total station.

This routine is typically used for topo work, where the total station remains over a single occupy point during all shots.

Note: Not all total stations support record mode.

Settings: located at the top of the screen, is a shortcut to the Surveying Settings screen (Page R-33).

Foresight: is the point name that will be used when storing the next point. Once a point is stored, it will be incremented to the next available point.

Description: is the description for all the shots that are stored.

HR: is the length of the rod.

Start Recording: starts recording all shots performed from the total station.

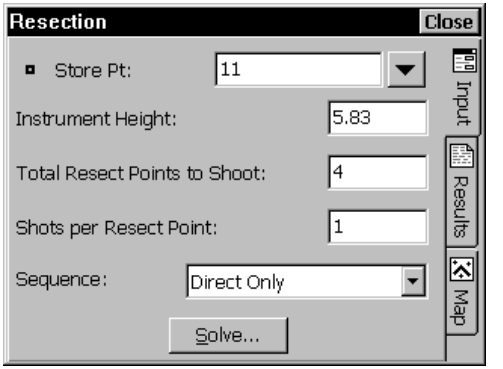
Stop: stops record mode.

Backsight...: accesses the Backsight Setup screen (Page R-72) where the current backsight can be modified.

Resection

3 Survey | N Resection

The Resection screen allows you to compute an unknown occupied position by shooting two to seven known positions.



Store Point: is the name that will be used when the new occupied point is stored.

Instrument Height: is the height of the instrument above the ground.

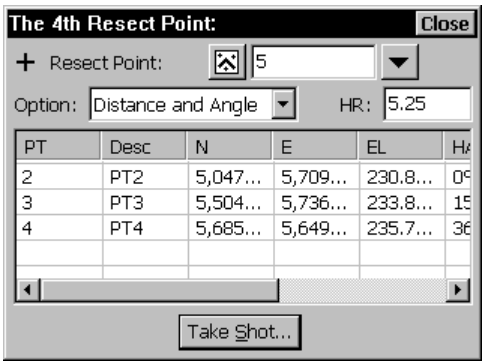
Total Resect Points to Shoot: is the number of known positions that will be shot, from 2 to 7.

Shots per Resect Point: is the required number of shots to shoot to each foresight when Direct Only is selected in the next field and is the required number of sets when Direct and Reverse is selected in the next field.

Sequence: is the set order when shooting each foresight. You can select either Direct and Reverse or Direct Only.

Solve...: accesses the Resection dialog box, described below, where all of the shots are performed.

Resection Dialog Box



Resect Point: is the known point that you will shoot.

Option: allows you to select the type of data that is recorded when shooting the specified foresight. You can select Distance and Angle, or if shooting at least three foresights, you can also select to record the Angle Only.

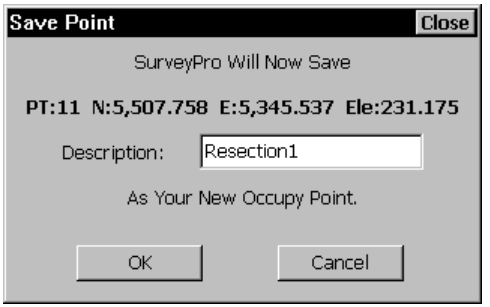
HR: is the length of the rod.

Take Shot...: takes a shot to the prism at the specified foresight point. After the last shot is

performed, the Save Point dialog box will open, described next.

Save Point Dialog Box

Once the final shot is completed, the Save Point dialog box will open showing the computed coordinates for the occupy point.



Description: is the desired description for the point that will be stored.

OK: stores the new point and automatically sets the point as the current occupy point.

Cancel: exits the dialog **without** storing a new point.

Results

Resection

OC N: is the computed northing of the Occupy Point.

OC E: is the computed easting of the Occupy Point.

OC Z: is the computed elevation of the Occupy Point.

Residuals

dRMS: is the average distance residual from all shots performed.

aRMS: is the average horizontal angle residual from all shots performed.

FS: is the foresight name.

dHD: is the distance difference of the measured shot and the computed shot. d(H)orizontal(D)elta

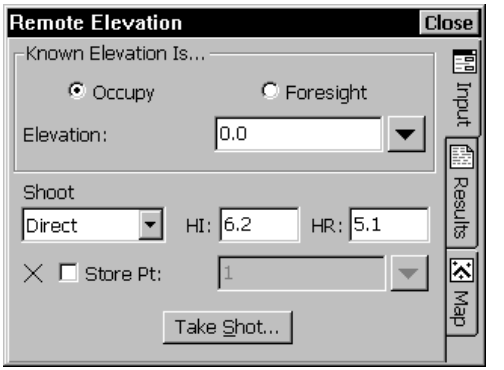
dHA: is the angle difference of the measured shot and the computed shot. d(H)orizontal(A)ngle

Remote Elevation

3 Survey | 0 Remote Elevation

The Remote Elevation screen will compute the elevation for the occupy point by shooting a foresight with a known elevation, or it will compute the elevation for a foresight when the occupy elevation is known.

Known Elevation Is…: is where you specify if the Occupy point or the Foresight point has a known elevation.



Elevation: is the known elevation for the selected point.

Shoot: defines if you want to perform a Direct shot only, or Direct & Reverse shots to the foresight.

HI: is the distance that the total station is above the ground.

HR: is the length of the rod.

☑ **Store Pt**: when checked, the elevation of the point specified here will be replaced with the computed elevation.

Take Shot...: computes the elevation for the point that had an unknown elevation and optionally writes that elevation to the specified Store Pt.

Results

OCC Elevation: displays the elevation for the occupy point.

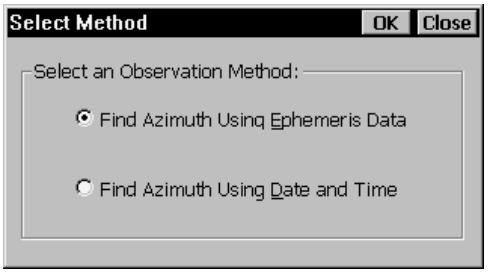
FS Elevation: displays the elevation for the foresight point.

Solar Observation

3 Survey | P Solar Observation

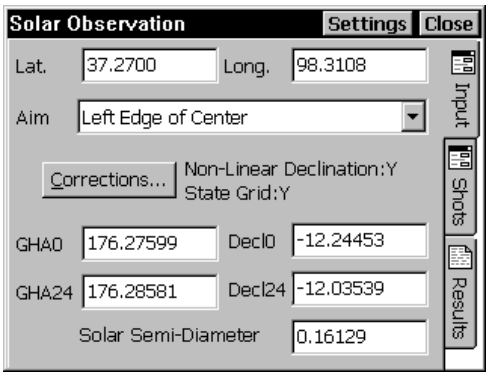
The Solar Observation screen is used to compute the azimuth to an arbitrary backsight based on the position of a celestial body; typically the sun.

WARNING! Direct viewing of the sun without a proper filter will cause serious eye damage. Pointing a total station directly toward the sun without a solar filter can also damage the EDM components.



Find Azimuth Using Ephemeris Data: select this method if you plan to enter data from an ephemeris.

Find Azimuth Using Date and Time: select this method if you do not plan to use an ephemeris.



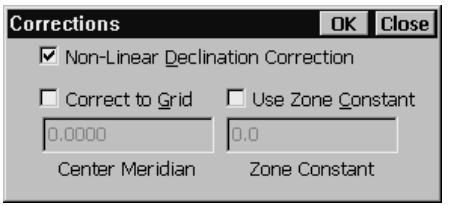
Note: The fields within the Solar Observations screen will vary depending on the method selected above. All of the fields from each method are described below.

Settings: located at the top of the screen, is a shortcut to the Date/Time Settings screen (Page R-37).

Lat. / **Long.**: is the latitude and longitude of the total station. These values can be scaled from a map, such as a U.S.G.S. 7.5-minute quadrangle sheet or collected with a handheld GPS unit.

Aim: selects the portion of the celestial body that where you intend to aim. You can select Left Edge of Center, Center, or Right Edge of Center.

Note: Typically Left Edge of Center is selected when performing a sun shot in the northern hemisphere and Center is selected for star shots.



Corrections: displays which corrections are currently selected with an N for no, or a Y for yes. When tapped, the Corrections dialog box opens where the following corrections are configured.

- ☑ **Non-linear Declination Correction**: applies a correction for the linear interpolation of the declination of the sun for the time that an observation is taken. This error is usually negligible, but is removed when this is checked. (This should only be checked when performing sun shots.)
- ☑ **Correct to State Grid**: when selected, the computed azimuth is referenced from the local State Plane grid rather than true north.
- ☑ **Center Meridian** / **Zone Constant**: these values are used to adjust the computed azimuth to the local State Plane grid. Appendix A lists these values for the United States.

GHA0: is the Greenwich Hour Angle of the sun at zero hour Universal Time, Greenwich, on the current date.

Decl0: is the declination of the sun at zero hour on the current date.

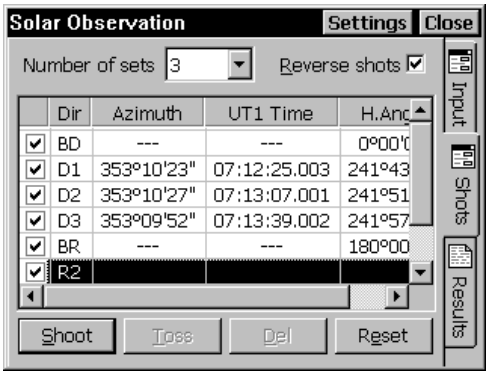
GHA24: is the Greenwich Hour Angle of the sun at zero hour Universal Time, Greenwich, on the following day (24-hours later).

Decl24: is the declination of the sun at zero hour on the following day.

Solar Semi-Diameter: is the semi-diameter of the sun, expressed in minutes and seconds.

Shots

Number of sets: is the number of sets that will be taken to the celestial object.



Reverse Shots ☑: when checked, reverse shots will be required with each set. When unchecked, only direct shots are required.

Shoot: accesses the Enter Shot Data screen, described below, where the shot data is entered for the selected observation.

Toss / Incl: will toggle the selected observation so that it will be hidden or un-hidden, respectively. When an observation is hidden, it will not be used when calculating the final azimuth.

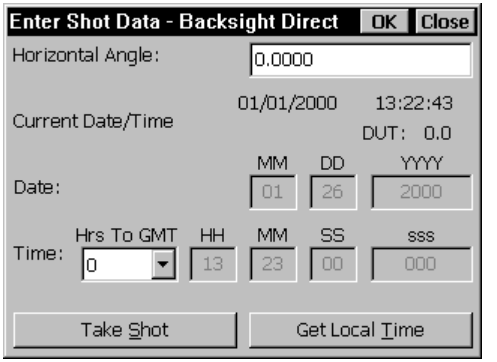
Note: The Toss / Incl buttons perform the same function as checking / un-checking the checkbox in front of each observation.

Note: A backsight observation cannot be tossed.

Del: permanently deletes the most current observation if it is selected allowing you to shoot that shot again.

Reset: permanently deletes all observations. A warning prompt will appear before the observations are deleted.

The Enter Shot Data Dialog Box



Horizontal Angle: displays the horizontal angle measured by the total station. This value is updated with the Take Shot button, described below.

Current Date / Time: displays the current date, time, and DUT. These settings can be changed from the Date/Time Settings screen (Page R-37).

Date: if incorrect, the current date should be entered here.

Time: is where the precise time that the observation occurred is entered.

Hrs to GMT: is the number of hours that the time at the current location differs from Greenwich Mean Time.

Take Shot: records the horizontal angle from the total station.

Get Local Time: fills in the Time field with the current time that is set in the data collector. This function is not available when shooting the backsight.

Sun Shot Procedure Summary

1. Point the telescope ahead of the path of the sun and lock the horizontal movement of the total station.
2. Immediately record the horizontal angle from the total station using the Take Shot button.
3. When the target becomes properly aligned with the crosshairs, record the current time as accurately as possible. The time can be automatically read from the data collector using the Get Local Time button, or measured from an external time piece and manually entered in the appropriate fields.
4. When finished, tap the OK button to complete the current observation.

When all observations are complete, the Results page displays the computed azimuth to the backsight.

Results

BS D/R: is the horizontal angle recorded to the backsight for the particular direct/reverse observation.

Azi D/R: is the computed azimuth to the backsight for the particular direct/reverse observation.

Avg: is the computed average azimuth of the backsight, relative to true north.

Grid Avg: is the computed average azimuth of the backsight, relative to the local State Plane grid. This field is only displayed when a state grid correction is applied.

Note: See the User's Manual for more information on the usage of the Solar Observation routine.

Remote Control

3 Survey | Q Remote Control or

Ctrl-[Y]

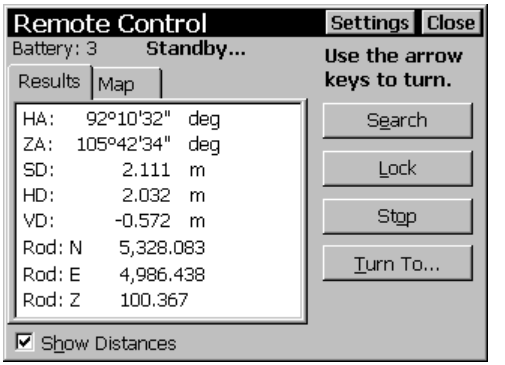
Remote control mode is a special mode that makes it easier for users to control fully robotic total stations from a remote data collector.

Note: The remote control functions are available only after a supported robotic total station is selected and enabled in the Instrument Settings screen.

Remote Control

The Remote Control screen allows you to turn the total station in any direction using the arrow buttons on the keypad and control the tacking functions.

The arrow keys are typically used to get the total station to aim in the general vicinity of the prism prior to initiating a search. The total station will continue to turn in the direction of the button as long as the button remains pressed.



↑: aims the scope upward.

↓: aims the scope downward.

→: turns the scope to the right (as you face the total station from the data collector).

←: turns the scope to the left.

Search: starts the search routine where the total station searches in a specific pattern until it "sees" the prism and then stops.

Lock: puts the total station in track mode where it will track the movements of the prism.

Stop: stops the total station from tracking or searching.

Turn To: opens the Turn To screen, described below, where the total station can be turned to a specified direction or quickly flipped between face one and face two.

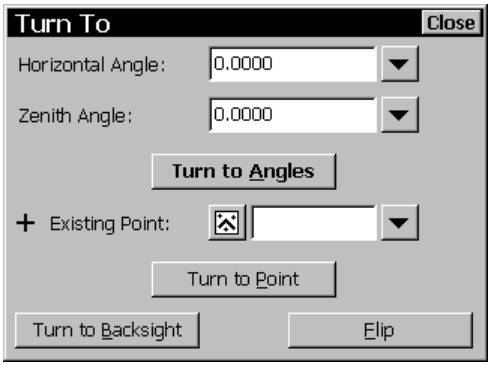
☑ **Show Distance**: when checked, distances will continuously measured and displayed on the data collector along with the angles.

Note: distances are always measured when a shot is taken, regardless of the Shoot Distance checkbox setting.

Turn To

3 Survey | M Remote Control | Turn To

The Turn To screen is used to turn a robotic total station to a specified horizontal and zenith angle, or to a specified point.



Horizontal Angle: is the horizontal angle that the total station will turn to.

Zenith Angle: is the zenith angle that the total station will turn to.

Turn to Angles: turns the total station to the specified horizontal and zenith angles.

Existing Point: is the point from the current job that the total station will turn to.

Turn to Point: turns the total station to the specified point.

Turn to Backsight: turns the total station to the backsight point.

Flip: quickly rotates the total station from face one to face two, or vice versa.

Stakeout Menu

The Stakeout Menu contains a variety of stakeout routines, including offset staking.

A: Stake Points

B: Stake List of Points

C: Stake to Line

D: Offset Staking

E: Slope Staking

F: Line and Offset

G: Curve and Offset

H: Spiral and Offset

I: Show Station (and Offset)

J: Store Offset Points

K: Stake DTM

L: Define a Location

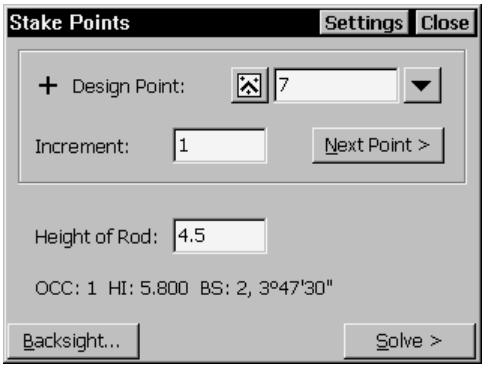
M: Where is Next Point

Note: The stakeout routines behave differently when running in remote control mode. For a description of this special mode, refer to Page R-100, and the Remote Control section of the User's Manual.

Stake Points

4 Stakeout | A Stake Points

The Stake Points screen allows you to stake a single point or a series of points.



Settings: located at the top of the screen, accesses the Stakeout Settings screen (Page R-34).

Design Point: is the name of the first point that you want to stake.

Increment: when advancing to the next point, the point number is incremented by the value entered here.

Next Point >: advances the current Design Point by the Increment value. If that point does not exist and the Increment value =1, the Design Point is advanced to the next existing point.

Height of Rod: is the length of the rod.

Backsight...: accesses the Backsight Setup screen (Page R-72).

Solve >: takes you to the second Stake Points screen where the distance and direction to the design point is displayed, see below.

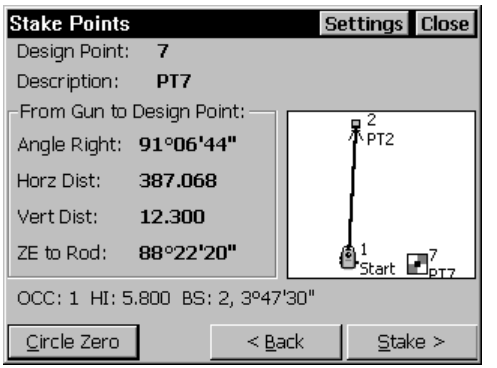
Stake Points – Screen Two

Design point: displays the name of the design point that was entered in the first screen.

Description: displays the description assigned to the design point.

Angle Right: is the horizontal angle to turn to face the design point.

Horz. distance: is the horizontal distance from the occupy point to the design point.



Vert. distance: is the vertical distance from the occupy point to the design point.

ZE to Rod: is the zenith angle required to face the prism over the design point.

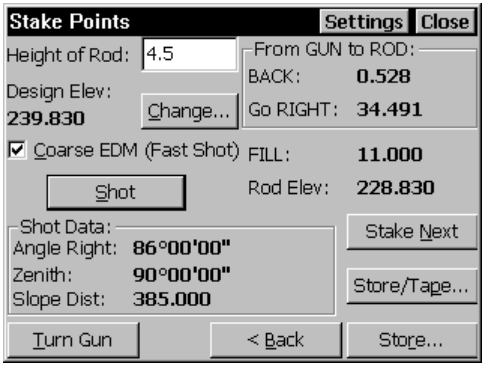
Circle Zero: is used to modify the circle on the total station so that the angle right reading will be zero when it is facing toward the design point, which can sometimes be easier than turning to an obscure angle value. When this button is tapped, the following actions will occur:

1. A new backsight circle value is computed, sent to the instrument and stored in the raw data
2. The Angle Right value is changed to zero to reflect the change. The instrument now needs to be turned horizontally to zero to face the design point.
3. To prevent errors, the backsight set up is invalidated when exiting the Stakeout dialog if this button has been used. A Circle zeroed on a design point is meaningless once the design point has been staked.

< Back: returns to the first screen.

Stake >: accesses the third and final Stake Points screen where the shots to the stake point are performed.

Stake Points – Screen Three



Height of Rod: is the length of the rod.

Design Elev: displays the current design elevation, which can be modified with the Change... button.

FORWARD / **BACK**: indicates if the rod must move forward (toward the total station) or backward (away from the total station).

Go RIGHT / **Go LEFT**: indicates if the rod must move to the right or left from the total station's point of view.

☑ **Coarse EDM (Fast Shot)**: when checked, sets the total station to coarse mode for faster, but slightly less-precise measurements.

CUT / **FILL**: displays the required amount of cut or fill to bring the stake point to the design point's elevation.

Rod Elev: displays the elevation at the rod's location computed from the last shot.

Change... : is used to modify the current design elevation, which will also modify the associated CUT/FILL value for the current station being staked.

Shot : takes a shot to the prism and computes come/go, cut/fill information.

Shot data: displays the measurements from the last shot.

Stake Next : returns you to the previous Stake Points screen where the Design point is advanced by the Increment value.

Store/Tape... : accesses the Store Point (Tape Offset) dialog box (Page R-129), where the staked point can be stored that includes a specified offset.

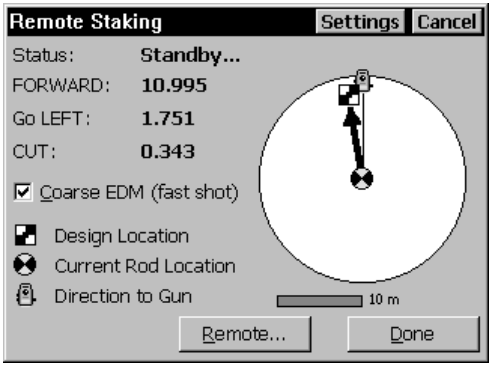
Turn Gun : turns the total station toward the design point.

< Back : returns to the second screen.

Store... : stores the stake point.

Remote Staking

4 Stakeout | A Stake Points | Solve > | Stake >

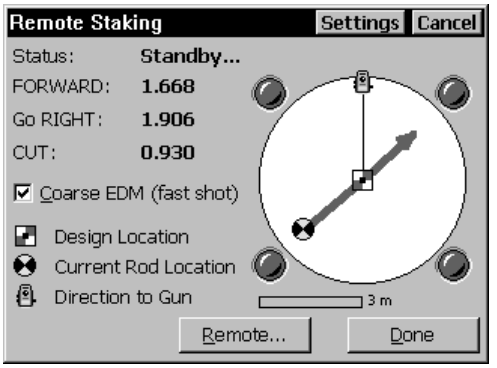


Display when prism is more than 3-meters from the target.

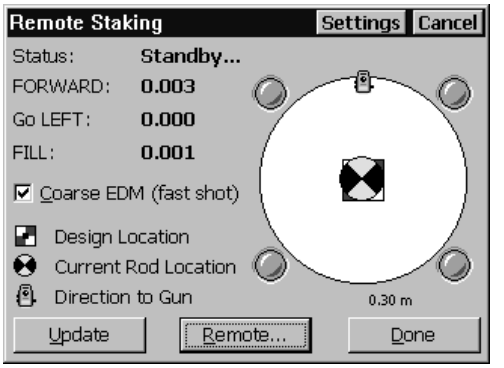
Performing stake out in remote mode is different from running in a non-remote mode because the feedback is continuous and provided in the rod's point of view instead of the total station's point of view.

There are three different graphic displays of the Remote Staking screen, depending on how close the rod is to the stake point. Each screen is shown here.

Done: when you are satisfied with the location of the prism, this button will open the Stake Point screen (see Page R-104) where the staked point can be stored.



Display when prism is within 3 meters from the target.

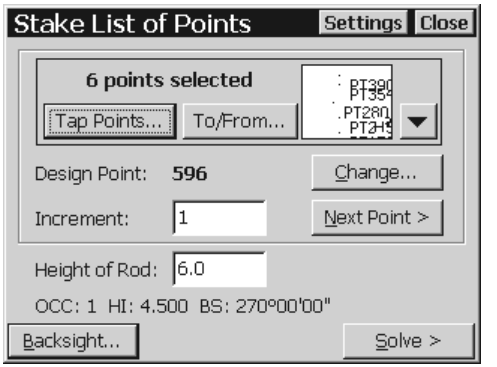


Display when the prism is within the Horizontal Distance Tolerance specified in the Stakeout Settings screen (Page R-34).

Stake List of Points Screen

4 Stakeout | B Stake List of Points

The Stake List of Points screen is used to stake points from a specified list of points. Points can also be selected by description or polyline.



Settings: located at the top of the screen, accesses the Stakeout Settings screen (Page R-34).

Tap Points...: displays a map of the current job. Simply tap the points that you want to stake and then tap OK.

To/From...: opens a window where a range of points can be defined. The points within the specified range can then be staked.

▼: Allows you to select points using a variety of other methods including: select all points; all control points; all non-control points; by description; or by polyline.

Design Point: displays the point to be staked. The initial Design Point is the first point of the selected polyline or point range.

Change...: opens the Edit Point List screen where the current point list can be edited.

Increment: is the number of points to advance from the Design Point after tapping Next Point >.

Height of Rod: is the length of the rod.

Next Point >: Advances the Design Point by the Increment and automatically solves to open the Stake List of Points screen where you can begin staking the point. The points are advanced in the same order that they were defined when the polyline was created or when the point range was defined.

Backsight...: accesses the Backsight Setup screen (Page R-72).

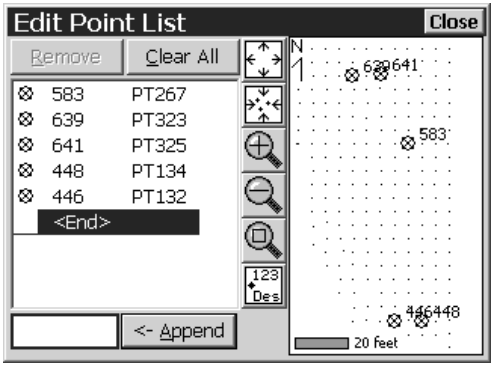
Solve > : opens the next Stake List of Points screen where the current Design Point can be staked.

Note: The screens available after tapping Solve > or Next Point > are identical to Screens Two and Three in the Stake Points routine and are described on pages R-104 through R-105.

Edit Point List

3 Stakeout | B Stake List of Points | Change or

3 Stakeout | B Stake List of Points | ▼ **Edit List...**



The Edit Point List screen is used to modify the existing point list.

Remove : removes the selected point from the point list.

Clear All : removes all the points from the point list.

To Closest : is available only when the screen is accessed with the Change button. This will automatically select the point in the point list that is nearest to the previously staked point, which is the selected point when the screen if first accessed.

<- Insert / <-Append : will insert the point specified in the corresponding field above the point selected in the point list. When <End> is selected, the point is appended to the end of the list.

Change to : is available only when the screen is accessed with the Change button. This is used to stake the point currently selected in the point list.

Stake to Line

4 Stakeout | C Stake to Line

The Stake to Line screen allows you to locate points on a continuous

predefined line starting from shots to a prism at any location. Direction information is provided for the rod to locate the line by traveling the shortest possible distance (a perpendicular offset to the line) and by traveling on the line between the rod and the total station.

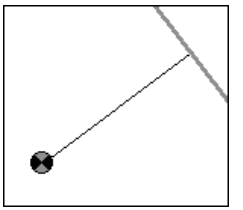
Start Point: defines the first point of the line to be staked.

▸ End Point / ▸ Direction: defines the second point on the line, or the direction of the line to be staked, respectively.

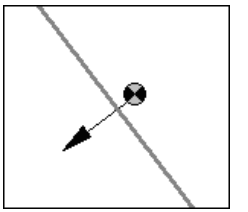
Begin Station: defines the station associated with the Start Point.

Backsight...: accesses the Backsight Setup screen (Page R-72).

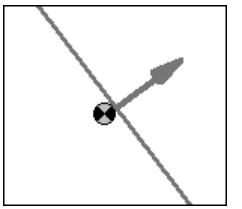
Stake>: takes you to the second Stake Points screen, described below.



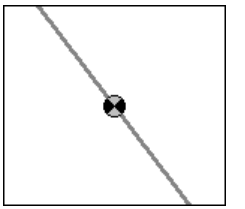
Graphic when prism is greater than 10-feet from the line.



Graphic when prism is between 1-foot and 10-feet from the line.



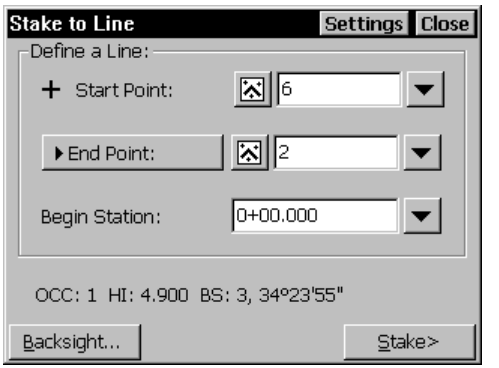
Graphic when prism is within 1-foot of the line



Graphic when prism is on the line or within the Horizontal Distance Tolerance specified in the Stakeout Settings screen (Page R-34).

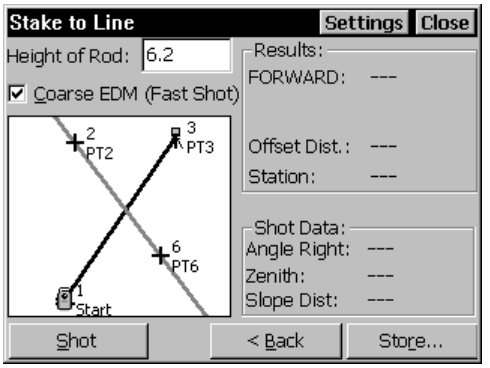
Stake to Line – Screen Two

The second screen is where the staking is performed. The graphic display of this screen will change depending on how close the rod is to the specified line. The initial screen that is displayed before a shot is performed shows the position of the total station, the line of the backsight and the specified line to stake. Each



type of graphic is displayed below.

Note: Tap the graphic portion of the screen for an expanded view.



Initial screen before a shot is performed

Height of Rod: is the length of the rod.

☑ **Coarse EDM (fast shot)**: when checked, sets the total station to coarse mode for faster, but slightly less precise measurements.

BACK / **FORWARD**: is the distance that the rod must travel BACK (away from the total station) or FORWARD (toward the total station) in order to occupy the specified line.

LEFT of Line / **RIGHT of Line** / **ON LINE**: is displayed if the rod is to the left or right side of the line, or is on the line. The LEFT and RIGHT side is determined as if occupying the Start Point and facing the Foresight Point or Direction of the line, specified in Screen One. ON LINE is determined if you are within the Horizontal Distance Tolerance specified in the Stakeout Settings screen (Page R-34).

Offset Dist.: is the perpendicular offset from the specified line to the rod. This is the minimum distance that the rod must travel to occupy the line.

Station: is the station on the specified line where the offset occurs, relative to the Start Point.

Shot Data: displays the information measured by the total station during the previous shot.

Shot: takes a shot to the prism.

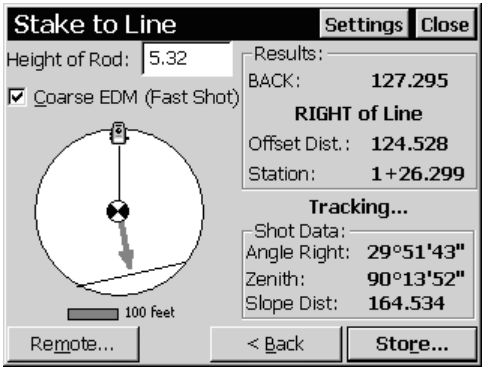
< Back: returns to Screen One.

Store: opens the Store Point dialog so you can store the last point that was shot.

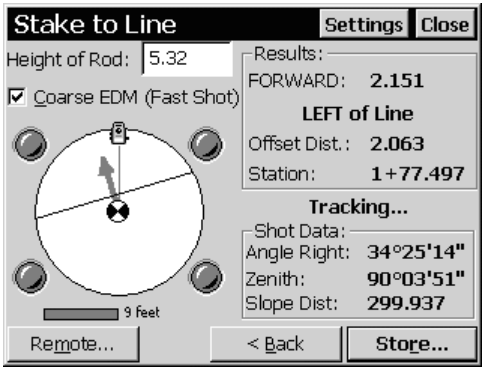
Remote Stake to Line

The content of the Stake to Line screen when running in remote mode is nearly identical to running in non-remote mode, but the graphic portion of the screen looks and behaves differently. The graphic is more intuitive – simply point the data collector toward the total station and the graphic tells you the orientation of the line and what direction to travel to reach the line in the shortest distance. (See the illustrations below.)

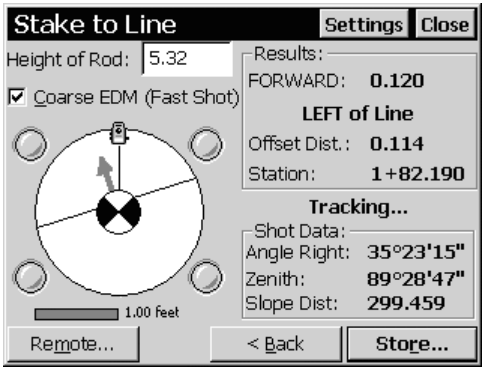
If the Use Manual Updating (Remote Control) field is checked in the Stakeout Settings screen (Page R-34), a Shot button will be available, which allows you to manually control when shots are taken.



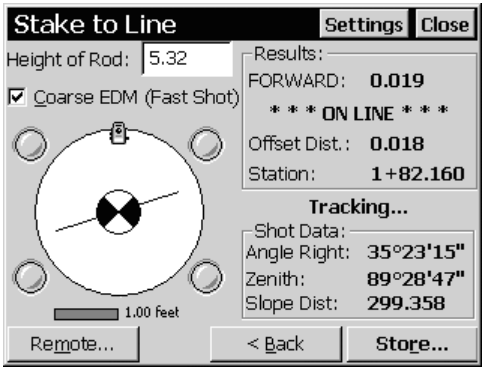
Prism is greater than 10 feet from line.



Prism is between 1 and 10 feet from line.



Prism is within 1 foot of line.

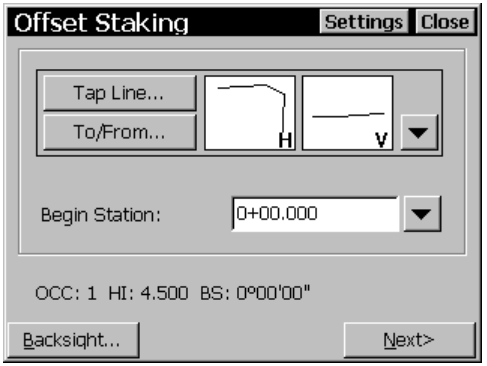


Prism is on the line or within the horizontal distance tolerance specified in the Stakeout Settings screen (Page R-34).

Offset Staking

4 Stakeout | D Offset Staking

The Offset Staking screen is used to stake the center of a road, the road edge, the curb/ditch edge, or any offset at fixed intervals. An existing polyline, alignment, or a specified point range can define the centerline of the road.



The first Offset Staking screen is used to define the centerline of the road that you want to offset stake.

Tap Line...: displays a map of all the polylines and alignments in the current job. Simply tap the line that you want to offset stake and then tap OK.

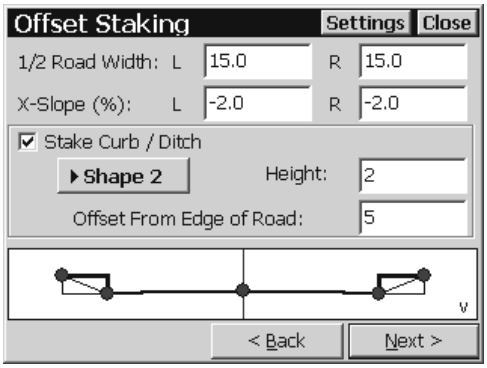
To/From...: opens a window where a range of points can be defined. The points within the specified range will define the centerline of the road to be offset staked.

Begin Station: is the station assigned to the first point of the selected polyline or point range.

Backsight...: accesses the Backsight Setup screen (Page R-72).

Next>: takes you to the second Offset Staking screen.

Offset Staking – Screen Two



The second Offset Staking screen is used to define the cross section of the road that you want to offset stake.

1/2 Road Width: is the **L**eft and **R**ight width of the road, respectively, from the centerline to the edge of payment. (See diagram below.)

X-Slope (%): is the **L**eft and **R**ight slope of the road, respectively, from the centerline to the edge of payment.

Note: A negative slope will result in water running from the centerline toward the edge of payment.

☑ **Stake Curb / Ditch**: when checked, a curb or ditch and an offset can be defined beyond the edge of the pavement.

[▸ Shape 1] / [...2] / [...3]: when the above checkbox is checked, this button allows you to select the shape of the curb, ditch, or slope beyond the edge of pavement so cut / fill information can be computed on this surface if a random offset is specified. The selected shape is displayed with a bold line in the road's cross-sectional profile at the bottom of the screen.

Note: The selected Shape is irrelevant if a random offset is not specified since the nodes are always in the same place for each shape that uses the same Height and Offset values.

Height: is the height of the curb, ditch, or slope in feet or meters. A positive value is considered a curb and a negative value a ditch.

Offset From Edge of Road: is the distance that the curb or ditch extends from the edge of pavement.

Note: The specified curb or ditch height and offset will be applied to both sides of the road.

[< Back]: returns to the previous screen.

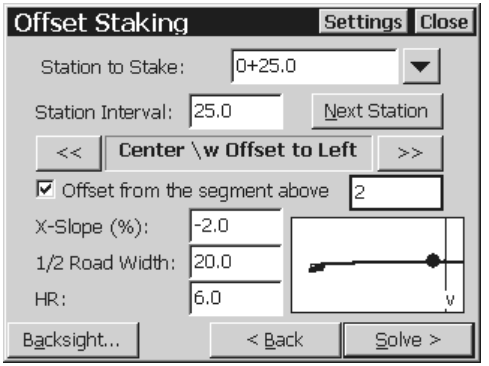
[Next >]: accesses the next screen.

Offset Staking – Screen Three

The third Offset Staking screen is used to select the station and section of the road to be staked and to specify an offset distance from the design point.

Station to Stake: is the station to be staked.

Station Interval: specifies how far to advance from the current station to the next station.



Next Station: advances the current station by the Station Interval.

Note: When advancing, if you want to also stake the locations where the alignment of the road changes, be sure to check the Stake "Corners", Not Just Even Intervals option in the Stakeout Settings card. Tapping the Settings button at the top of the screen will access the Stakeout Settings.

<< / >>: These buttons are used to select the section of the road that you want to stake.

☑ **Offset from the segment above** ___: when checked, is the offset distance that will be applied to the selected design point. A positive offset extends from the design point away from the centerline. A negative offset extends towards the centerline.

X-Slope (%): is the slope of the selected road section.

1/2 Road Width: displays the width of the selected road section defined in the previous screen. This value can quickly be edited from this field.

HR: is the rod height.

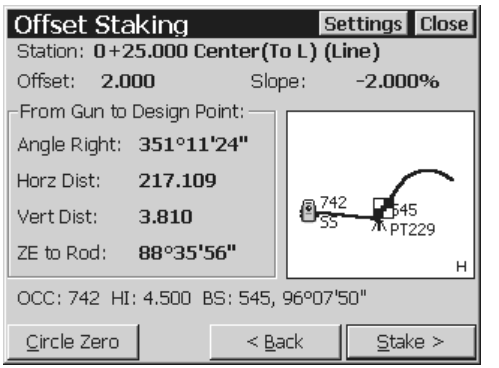
Backsight...: accesses the Backsight Setup screen (Page R-72).

< Back: returns to the previous screen.

Solve >: accesses the next screen.

Offset Staking – Screen Four

The fourth Offset Staking screen displays the information needed to aim the total station toward the selected design point.



Station: displays the current station and section of the roadway being staked and the current line segment type from the polyline that describes the centerline. If staking the center and an offset was specified, (To L) or (To R) is also displayed to indicate if the offset is to the left or right of the centerline, respectively.

Offset: displays the offset that is applied to the design point.

Slope: displays the slope of the road at the section being staked.

From Gun to Design Point: displays the angle and distance information from the total station to the design point (plus offset if specified).

Circle Zero: is used to modify the circle on the total station so that the angle right reading will be zero when it is facing the current target, which can sometimes be easier than turning to an obscure angle value. When this button is tapped, the following actions will occur:

1. A new backsight circle value is computed, sent to the instrument and stored in the raw data
2. The Angle Right value is changed to zero to reflect the change. The instrument now needs to be turned horizontally to zero to face the current target location.
3. To prevent errors if this button is used, the backsight set up is invalidated when exiting the Stakeout dialog. A circle zeroed on a design point is meaningless once the design point has been staked.

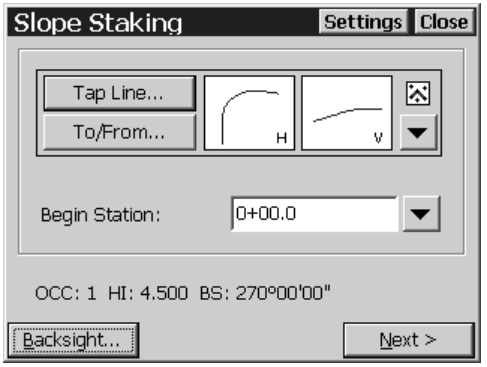
< Back: returns to the previous screen.

Stake >: accesses the next screen, which is identical to the third Stake Points screen, described on Page R-105.

Slope Staking

4 Stakeout E Slope Staking

The Slope Staking screen is used to locate the catch points for a roadway in any terrain.



The first screen is used to define or select the line that describes the centerline of the road to be slope staked. An existing polyline or alignment can be selected, or a series of existing points can be entered to define the centerline.

Tap Line...: allows you to tap an existing polyline or alignment that defines the centerline of the road.

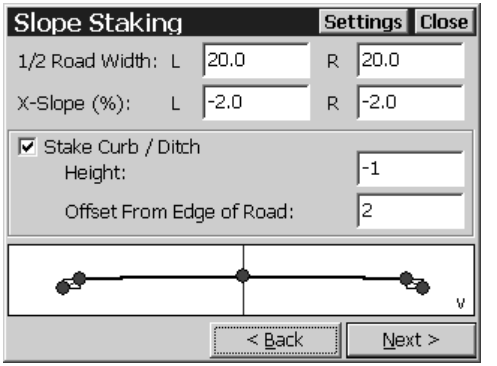
To/From...: allows you to enter a range of points to define the centerline of the road.

Begin Station: defines the station at the beginning of the centerline.

Backsight...: accesses the Backsight Setup screen.

Next>: opens the next screen.

Slope Staking – Screen Two



The second screen is used to describe the profile of the road.

1/2 Road Width: is the horizontal width of **L**eft and **R**ight sides of the road, respectively, from the centerline to the nearest edge of the curb or ditch.

X-Slope: is the cross slope of the **L**eft and **R**ight sides of the road, respectively. The slope is computed from $(\frac{\text{Rise}}{\text{Run}} \cdot 100)$. (A negative slope will cause water to run from the centerline toward the edge.)

☑ **Stake Curb / Ditch**: When checked, this allows you to include a curb or ditch in the road profile.

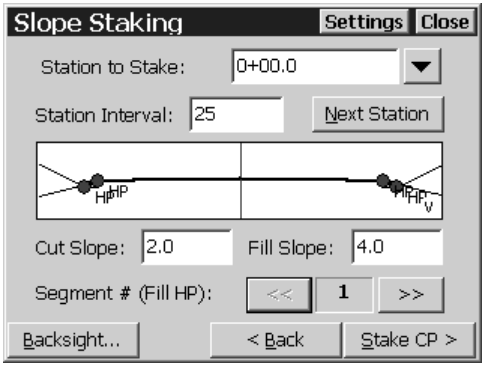
Height: defines the height of the curb, or depth of the ditch. (A negative value would be used to define the depth of a ditch.)

Offset From Edge of Road: defines the width of the curb or ditch.

< Back: returns to the previous screen.

Next >: opens the next screen.

Slope Staking – Screen Three



Station to Stake: is the station that will be staked next.

Station Interval: is the value that is added to the Station to Stake after the Next Station button is pressed.

Next Station: advances the Station to Stake by the Station Interval.

Note: If the Stake Corners option is selected in the Stakeout Settings screen, the Next Station button will also stop at any horizontal or vertical alignment node that falls within the interval.

Fill Slope: is the desired slope, calculated from rise over run, between the hinge point and catch point when the area requires a fill.

Cut Slope: is the desired slope, calculated from rise over run, between the hinge point and catch point when the area requires a cut.

Segment # (Fill HP): when the terrain requires a fill, you have the option to compute the hinge point from either side of the second segment. The option to use segment # 1 can simplify the situation where a ditch meets an area requiring a fill, which would otherwise result in an area with two similar or identical negative slopes.

< Back: returns to the previous screen.

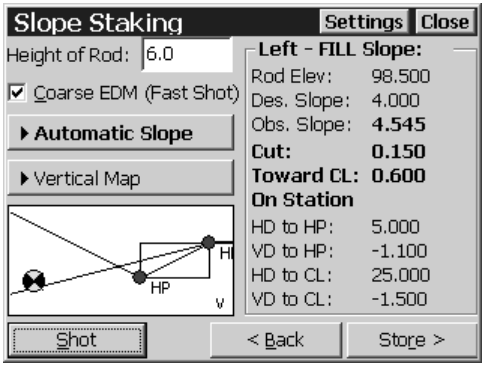
Stake CP >: opens the next screen.

Slope Staking – Screen Four

The fourth screen is used to perform the actual slope staking shots.

Height of Rod: is the rod height.

☑ **Coarse EDM (Fast Shot)**: when checked, sets the total station to coarse mode for faster, but slightly less-precise measurements.



The first button selects the type of slope that will be used between the catch point and hinge point from the following options:

- Automatic Slope: selects the slope based on the current rod position. If the rod is above the hinge point, a cut slope is computed. If the rod is below the hinge point, a fill slope is computed.

- ▸ Force CUT Slope: forces all computations to be based on a cut slope.
- ▸ Force FILL Slope: forces all computations to be based on a fill slope.

The second button selects which information is displayed in the lower corner of the screen from the following options:

- ▸ Vertical Map: displays a cross-sectional view at the current station.

Note: When you tap a map view, an expanded view of the same map will fill the screen.

Note: The Vertical Map will show an X at the location of each previous shot. This can be useful in determining if the current terrain will never intersect the slope (no catch point).

- ▸ Horizontal Map: displays an overhead view of the job.
- ▸ Shot Data: displays the shot data for the latest shot.

Left / Right: displays if a Cut or Fill slope is being computed and if it is on the Left or Right side of the road, respectively.

Rod Elev: is the current elevation at the rod location.

Des. Slope: is the design cut or fill slope.

Obs. Slope: is the computed (observed) cut or fill slope based on the last shot and the corresponding hinge point.

Cut / Fill: is the cut or fill required for the current rod location to be positioned on the design slope.

Toward CL / Away CL: is the computed horizontal distance that the rod must move either toward the centerline or away from it, respectively, before it is positioned at the catch point.

Note: The computed horizontal distance is based on the observed terrain computed from the last two shots. If only one shot has been

taken, it is assumed that the terrain is level when computing this value.

On Station / **Back Sta** / **Ahead Sta**: informs you if the rod is on the station being staked, or the distance it must move (parallel to the centerline) back or ahead to be on the correct station.

HD to HP: is the horizontal distance from the rod to the hinge point.

VD to HP: is the vertical distance from the rod to the hinge point.

HD to CL: is the horizontal distance from the rod to the centerline.

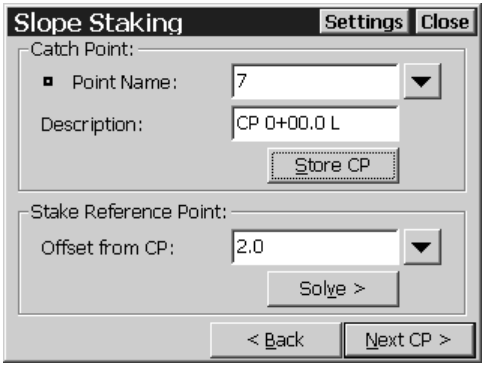
VD to CL: is the vertical distance from the rod to the centerline.

< Back: returns to the previous screen.

Store >: opens the next screen.

Slope Staking – Screen Five

The fifth screen is used to store a point for the last shot taken from the previous screen, which should be located at the catch point.



Point Name: is the name assigned to the stored point.

Description: is the description assigned to the stored point.

Store CP: stores the point.

Offset from CP: This field is used if you want to stake another location that is at the specified horizontal distance from the catch point away from the road.

Solve >: opens a new screen, described next, used to stake the point at the offset specified above.

< Back: returns to the previous screen.

Next CP >: returns to the third slope staking screen where the station to stake can be advanced and the next catch point can be located.

Slope Staking Offset Stake – Screen One

The following screens are only accessed if you choose to stake a point at a specified offset away from the catch point.

Station: displays the current station being slope staked.

Offset from CP: is the offset from the catch point specified in the previous screen.

From Gun to Design Point: displays the angle and distance information from the total station to the design point.

Circle Zero: is used to modify the circle on the total station so that the angle right reading will be zero when it is facing the current target, which can sometimes be easier than turning to an obscure angle value. When this button is tapped, the following actions will occur:

1. A new backsight circle value is computed, sent to the instrument and stored in the raw data
2. The Angle Right value is changed to zero to reflect the change. The instrument now needs to be turned horizontally to zero to face the current target location.
3. To prevent errors if this button is used, the backsight set up is invalidated when exiting the Stakeout dialog. A circle zeroed on a design point is meaningless once the design point has been staked.

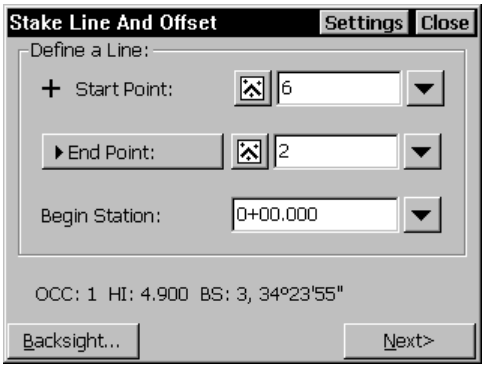
< Back: returns to the previous screen.

Stake >: accesses the next screen, which is identical to the third Stake Points screen, described on Page R-105.

Stake Line and Offset

4 Stakeout | F Line and Offset

The Stake Line and Offset screen is used to stake stations on a line, or at an offset to it, at fixed intervals.



Settings: located at the top of the screen, accesses the Stakeout Settings screen (Page R-34).

Start Point: defines the first point of the line to be staked.

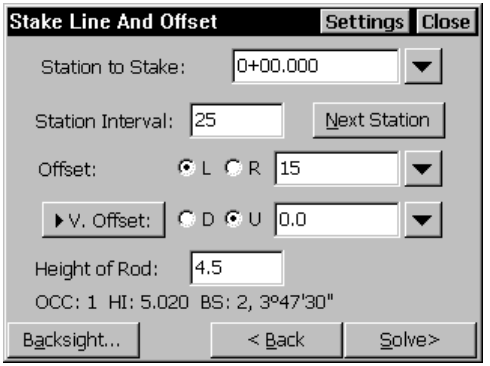
End Point / Direction: defines the second point of the line, or the direction of the line to be staked, respectively.

Begin Station: defines the station associated with the Start Point.

Backsight...: accesses the Backsight Setup screen (Page R-72).

Next>: opens Screen Two.

Stake Line and Offset – Screen Two



Station to Stake: is the desired station that you want to stake.

Station Interval: is the value that is added to the Station to Stake after the Next Station button is pressed.

Next Station: advances the Station to Stake by the Station Interval.

Offset: defines the offset distance and if the offset occurs to the right of the line, when ◉R is selected, or left, when ◉L is selected. The right or left side is referenced while viewing the line from the Start Point.

[▸ Vertical Offset]: is the offset distance that is below the design location (when ⊙ D is selected) or above the design location (when ⊙ U is selected).

[▸ Grade:] specifies a slope from the specified line to the parallel line that is being staked. When this is a non-zero value, the elevation for the staked points will increasingly differ from the design elevations as the Offset value increases.

Height of rod: is the length of the rod.

[Backsight...]: accesses the Backsight Setup screen.

[< Back]: returns to the previous screen.

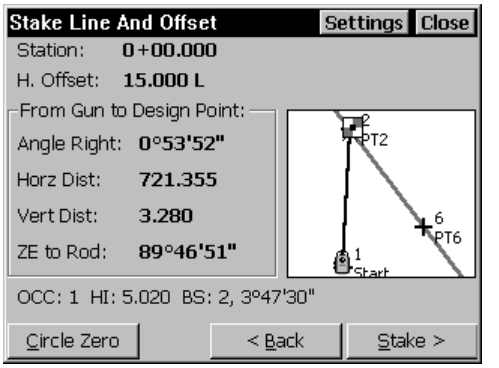
[Solve>]: accesses the third Stake Line and Offset screen, described next.

Note: A motorized total station will automatically turn toward the design point after pressing [Solve>] depending on the configuration of the Stakeout Settings screen (Page R-34).

Stake Line and Offset – Screen Three

Station: displays the current station that is being staked.

H. Offset: displays the offset distance of the line being staked from the specified line and if it is on the Right or Left side of the specified line.



From Gun to Design Point: displays the direction and distance that the total station must aim toward so that it is facing the current station.

[Circle Zero]: is used to modify the circle on the total station so that the angle right reading will be zero when it is facing the current target, which can sometimes be easier than turning to an obscure angle value. When this button is tapped, the following actions will occur:

1. A new backsight circle value is computed, sent to the instrument and stored in the raw data
2. The Angle Right value is changed to zero to reflect the change. The instrument now needs to be turned horizontally to zero to face the current target location.
3. To prevent errors if this button is used, the backsight set up is invalidated when exiting the Stakeout dialog. A circle zeroed on a design point is meaningless once the design point has been staked.

< Back: returns to the previous screen.

Stake >: accesses the fourth Stake Line and Offset screen, which is identical to the third Stake Points screen, described on Page R-105.

Note: Tap the graphic portion of the screen for an expanded view.

Screen Summary

Screen One is used to define the primary line used to determine the location of the line to be staked and the station associated with the Start Point.

Screen Two is used to define the offset distance and location, the station to be staked and the station interval.

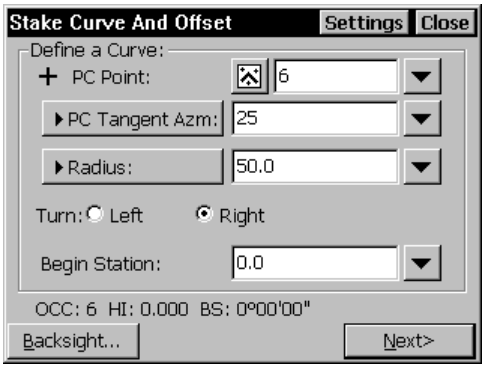
Screen Three provides the distance and direction information to the current station to be staked.

Screen Four is used to stake the current station.

Stake Curve and Offset

4 Stakeout | G Curve and offset

The Stake Curve and Offset screen is used to stake stations on a curve or at an offset to it at fixed station intervals.



Settings: located at the top of the screen, accesses the Stakeout Settings screen (Page R-34).

PC Point: is the starting point of the curve (point of curvature).

PC Tangent Azm / PC Tangent Brg: defines the azimuth or bearing, respectively, of the tangent at the PC Point.

Radius / Degree Arc / Degree Chord: defines the radius, degree arc, or degree chord of the curve, respectively.

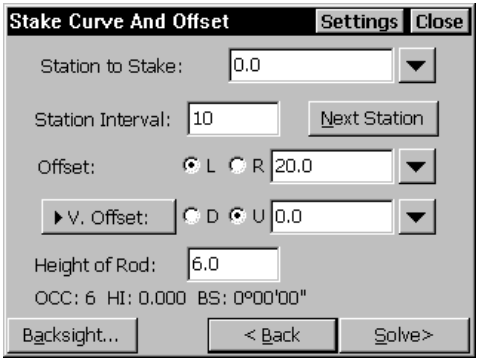
Turn: defines if the curve turns to the Left or Right from the point of view of the PC.

Begin Station: is the station assigned to the PC Point.

Backsight...: accesses the Backsight Setup screen (Page R-72).

Next>: takes you to the second Stake Curve and Offset screen, described below.

Curve and Offset – Screen Two



Station to Stake: is the desired station on the curve that you want to stake.

Station Interval: is the value that is added to the Station to Stake after the Next Station button is pressed.

Next Station: advances the Station to Stake by the Station Interval.

Offset: is the horizontal distance of the offset from the specified curve. The offset occurs on the left (while viewing the curve from the PC) when the ◉ L is selected or on the right when the ◉ R is selected.

Note: An offset of zero would result in the specified curve being staked.

▸V. Offset: will result in the elevations for the design points to be adjusted by the value entered here and will change the cut / fill values accordingly. Design elevations will be lower when ◉ D is selected, and higher when ◉ U is selected.

▸Grade: specifies a slope from the specified curve to the curve that is being staked. When this is a non-zero value, the elevation for the staked points will increasingly differ from the corresponding design elevations on the specified curve as the Offset value increases.

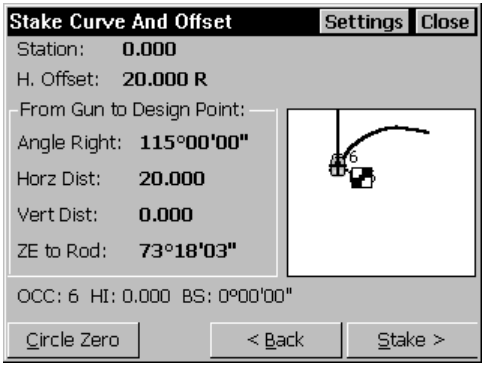
Height of Rod: is the length of the rod.

< Back: returns to the previous screen.

Solve>: accesses the third Stake Curve and Offset screen, described next.

Note: A motorized total station will automatically turn toward the design point after tapping Solve>, depending on the configuration of the Stakeout Settings screen (Page R-34).

Curve and Offset – Screen Three



Station: displays the current station that is being staked.

H. Offset: displays the offset distance of the curve being staked from the specified curve and if it is on the Right or Left side of the specified curve.

Angle Right: is the horizontal angle that the total station must aim toward so that it is facing the current station.

Horz. distance: is the horizontal distance from the occupy point to the current station.

Vert. distance: is the vertical distance from the occupy point to the current station.

ZE to Rod: is the zenith angle that the total station must aim toward so that it is facing the current station.

Circle Zero: is used to modify the circle on the total station so that the angle right reading will be zero when it is facing toward the design point, which can sometimes be easier than turning to an obscure angle value. When this button is tapped, the following actions will occur:

1. A new backsight circle value is computed, sent to the instrument and stored in the raw data.
2. The Angle Right value is changed to zero to reflect the change. The instrument now needs to be turned horizontally to zero to face the design point.
3. To prevent errors, the backsight set up is invalidated when exiting the Stakeout dialog if this button has been used. A circle zeroed on a design point is meaningless once the design point has been staked.

< Back: returns to the previous screen.

Stake >: accesses the next screen, which is identical to the third Stake Points screen, described on Page R-105.

Screen Summary

Screen One is used to define the primary curve used to determine the location of the curve to be staked and the station associated with the PC Point.

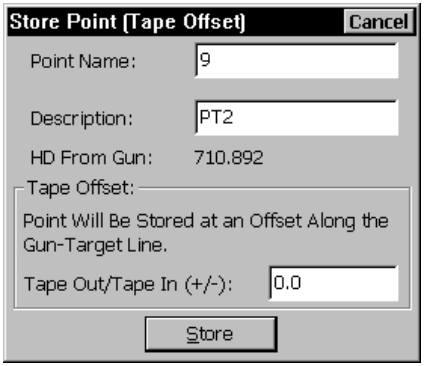
Screen Two is used to define the offset distance and location, the station to be staked and the station interval.

Screen Three provides the distance and direction information to the current station to be staked from the occupy point.

Screen Four is used to stake the current station.

Store Point (Tape Offset) Dialog Box

The Store Point (Tape Offset) dialog box allows you to store a point at a specified offset from the stake point, resulting in a point that is either closer to, or further away from the total station.



Point Name: is the name assigned to the new offset point.

Description: is the description assigned to the new offset point.

HD from gun: displays the current horizontal distance to the prism.

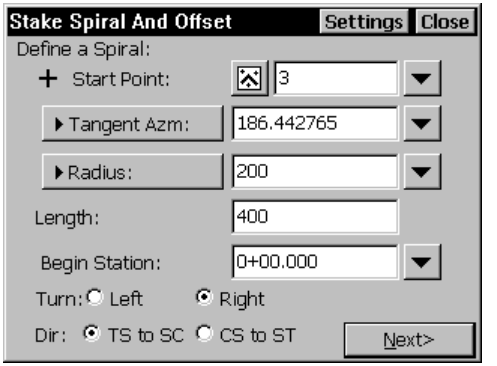
Tape Out/Tape In: is the specified offset from the stake point. A positive value will result in a new point that is further away from the total station.

Store: stores the new offset point.

Stake Spiral and Offset

4 Stakeout | H Spiral and Offset

The Stake Spiral and Offset screen allows you to stake stations at fixed intervals on a spiral curve, or at an offset to it.



Start Point: is the point associated with the beginning of the spiral curve. This can either be the TS or the CS, which is specified later in this screen (see below).

Tangent Azm / Tangent Bearing: defines the tangent azimuth or bearing at the entrance to the spiral

Radius / Degree Arc / Degree Chord: defines the radius, degree arc, or degree chord of the curve, respectively.

Length: is the length of the spiral curve.

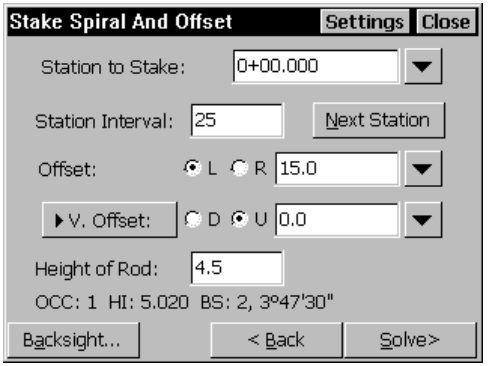
Begin Station: is the station associated with the Start Point.

Turn: defines if the curve turns toward the Left or Right from the point of view of the Start Point.

Spiral: defines the direction of the spiral curve by the following options:

- **TS to SC**: the spiral begins at the tangent (Tangent to Spiral) and ends at the circular curve (Spiral to Curve).
- **CS to ST**: the spiral begins at the circular curve (Curve to Spiral) and ends at the tangent (Spiral to Tangent).

Stake Spiral and Offset – Screen Two



Station to Stake: is the desired station on the spiral curve that you want to stake.

Station Interval: is the value that is added to the Station to Stake after the Next Station button is pressed.

Next Station: advances the Station to Stake by the Station Interval.

Offset: is the horizontal distance of the offset from the spiral curve. The offset occurs on the left (while viewing the spiral from the Start Point) when the ⊙L is selected or on the right when ⊙R is selected.

Note: An offset of zero would result in the spiral curve itself being staked.

▸V. Offset: will result in the elevations for the design points to be adjusted by the value entered here and will change the cut / fill values accordingly. Design elevations will be lower when is selected, and higher when ⊙U is selected.

▸Grade: specifies a slope from the spiral curve to the curve that is being staked. When this is a non-zero value, the elevation for the staked points will increasingly differ from the corresponding design elevations on the spiral curve as the Offset value increases.

Height of rod: is the length of the rod.

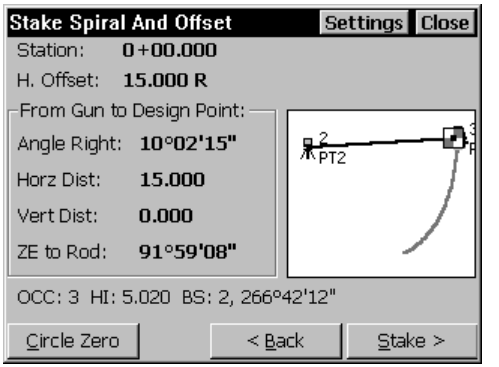
Backsight...: accesses the Backsight Setup screen (Page R-72).

< Back: returns to the previous screen.

Solve>: accesses the third screen, described next.

Note: A motorized total station will automatically turn toward the design point after pressing Solve> depending on the configuration of the Stakeout Settings screen (Page R-34).

Stake Spiral and Offset – Screen Three



Station: displays the current station that is being staked.

H. Offset: displays the offset distance of the spiral curve being staked from the specified spiral curve and if it is on the Right or Left side of the specified spiral curve.

Angle Right: is the horizontal angle that the total station must aim toward so that it is facing the current station.

Horz Dist: is the horizontal distance from the occupy point to the current station.

Vert Dist: is the vertical distance from the occupy point to the current station.

ZE to Rod: is the zenith angle that the total station must aim toward so that it is facing the current station.

Circle Zero: is used to modify the circle on the total station so that the angle right reading will be zero when it is facing toward the design point, which can sometimes be easier than turning to an obscure angle value. When this button is tapped, the following actions will occur:

1. A new backsight circle value is computed, sent to the instrument and stored in the raw data
2. The Angle Right value is changed to zero to reflect the change. The instrument now needs to be turned horizontally to zero to face the design point.

3. To prevent errors, the backsight set up is invalidated when exiting the Stakeout dialog if this button has been used. A circle zeroed on a design point is meaningless once the design point has been staked.

< Back: returns to the previous screen.

Stake >: accesses the next screen, which is identical to the third Stake Points screen, described on Page R-105.

Stake Spiral and Offset – Screen Summary

Screen One is used to define the primary spiral curve used to determine the location of the curve to be staked and the station associated with the Start Point.

Screen Two is used to define the offset distance and location, the station to be staked and the station interval.

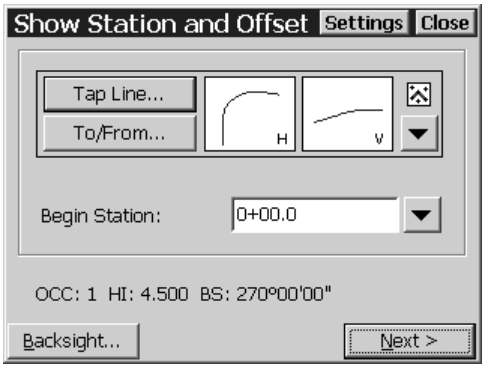
Screen Three provides the distance and direction information to the current station to be staked from the occupy point.

Screen Four is used to stake the current station.

Show Station and Offset

4 Stakeout | I Show Station

The Show Station and Offset routine allows you to take a shot to a prism that is positioned anywhere near a polyline, a range of points that define a line, or an alignment to see where the prism is located in relation to the line.



Tap Line...: allows you to tap an existing polyline or alignment that the station and offset will be computed from.

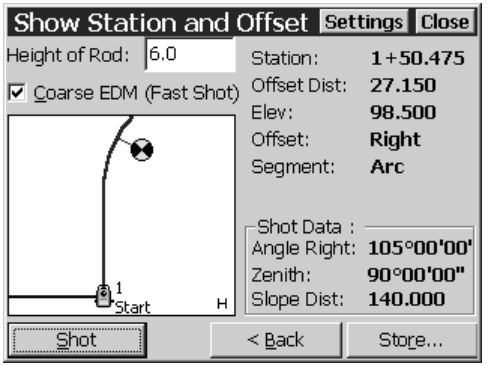
To/From...: allows you to enter a range of points that define the line where the station and offset will be computed from.

Begin Station: is the station assigned to the beginning of the line.

Backsight...: accesses the Backsight Setup screen (Page R-72).

Next >: takes you to the next Show Station and Offset screen where the slope staking parameters are set up.

Show Station and Offset – Screen Two



The second Show Station and Offset screen is used to take a shot to the prism and view the data.

Height of Rod: is the length of the rod.

☑ **Coarse EDM (Fast Shot)**: when checked, sets the total station to coarse mode for faster, but slightly less-precise measurements.

Station: displays the station at the rod position.

Offset Dist: displays the perpendicular offset from the centerline to the rod position.

Elev: displays the elevation at the rod position.

Offset: displays if the rod position is to the right of the line, left of the line, or on the line.

Segment: displays the name of the template's segment at the rod position.

Shot Data: displays the angles and distance measured by the total station from the last shot.

Shot: takes a shot to the prism.

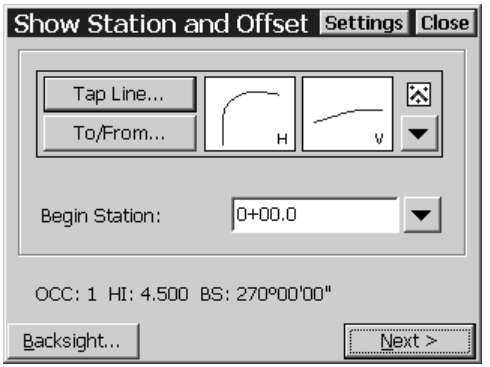
< Back: returns to the previous screen.

Store...: stores the stake point.

Store Offset Points

4 Stakeout | J Store Offset Points

The Store Offset Points screen is used to store points in the current job at a specified offset from an existing polyline or alignment at a specified interval.



Tap Line...: allows you to tap an existing polyline or alignment that the station and offset will be computed from.

To/From...: allows you to enter a range of points that define the line where the station and offset will be computed from.

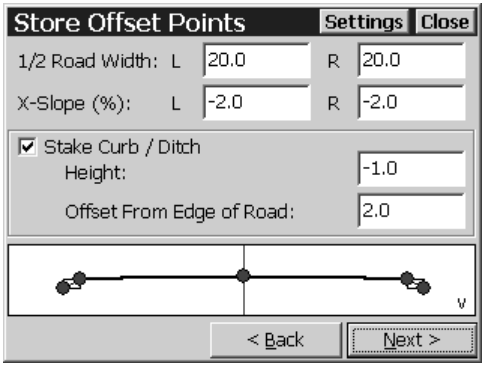
Begin Station: is the station assigned to the beginning of the line.

Backsight...: accesses the Backsight Setup screen (Page R-72).

Next >: takes you to the next Store Offset Points screen where the slope staking parameters are set up.

Store Offset Points – Screen Two

The second Store Offset Points screen is used to define the road profile, or offset distances that will be used to compute the offset point coordinates.



1/2 Road Width: is the Left and Right width of the road, respectively, from the centerline to the edge of payment.

X-Slope (%): is the Left and Right slope of the road, respectively, from the centerline to the edge of payment calculated from $\frac{\text{Rise}}{\text{Run}} \cdot 100$.

Note: A negative slope will result in water running from the centerline toward the edge of payment.

☑ **Stake Curb / Ditch**: when checked, a curb or ditch and an offset can be defined beyond the edge of the pavement.

Height: is the height of the curb or ditch in feet or meters. A positive value is considered a curb and a negative value a ditch.

Offset From Edge of Road: is the distance that the curb or ditch extends from the edge of pavement.

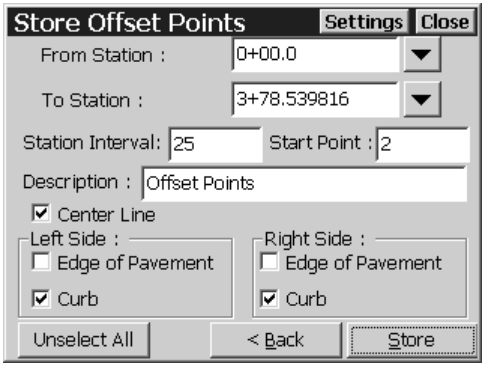
Note: The specified curb or ditch height and offset will be applied to both sides of the road.

< Back: returns to the previous screen.

Next >: accesses the next screen.

Store Offset Points – Screen Three

The third Store Offset Points screen is used to define which offset points will be stored.



From Station: is the station where the stored offset points will begin.

To Station: is the station where the stored offset points will end.

Station Interval: is the distance between the stations where offset points are stored.

Note: If the Stake Corners option is selected in the Stakeout Settings screen, offset points will also be stored where ever the horizontal or vertical section of the road changes.

Start Point: is the point number that will be assigned to the first offset point that is stored. Each stored point that follows will be assigned the next available point number.

Description: is the description that will be assigned to all the offset points that are stored.

☑ **Center Line**: offset points will be stored at locations on the centerline when checked.

☑ **Edge of Pavement**: offset points will be stored at the end of the first segment (the edge of the roadbed) on the left and/or right side when checked.

☑ **Curb**: offset point will be stored at the end of the second segment (the end of the curb or ditch) on the left and/or right side when checked.

Unselect All: quickly unchecks all the checkboxes.

< Back: returns to the previous screen.

Store: stores all the offset points based on the information provided.

Stake DTM

4 Stakeout | K Stake DTM

The Stake DTM routine allows you to stake an area and get cut / fill and volume information based on a reference DTM or specified elevation datum.

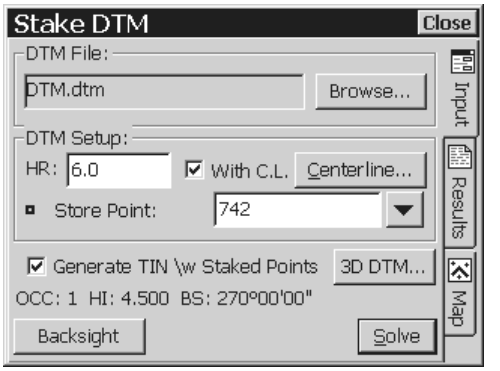
The routine requires either a DXF file containing a triangulated irregular network (TIN), or a digital terrain model (DTM) file for the area that you plan to stake, which is typically created from a previous topo job. This file will contain the elevation information at every location within the boundary of the original topo.

The DXF file can be created by opening the original job in TDS ForeSight and exporting the job to a DXF file. ForeSight provides several options for the information that is written to the DXF file, but all the options will include the required 3-D Face, or TIN information when exporting to a DXF file. Both TDS ForeSight and Survey Link will export a DTM file from a DXF file.

Note: The speed performance of the Stake DTM routine is enhanced when using a DTM file as opposed to a DXF file.

DTM File: displays the selected DTM or DXF file.

Browse...: allows you to select a DXF or DTM file.



Warning: If importing a DXF or DTM file where the distance units in the source file are different than the distance units for the current job, the imported coordinates will be converted to the current job's distance units when they are imported. This is normally the desired result, but it can cause a problem if the distance units for the imported data or the current job were set incorrectly. This situation can most commonly occur when working with Feet and US Survey Feet, where the conversion from one to the other is not always obvious.

Usually the difference between Feet and US Survey Feet is negligible (2 parts per million), but when dealing with State Plane or UTM mapping plane coordinates, which are often very large in magnitude, the difference can be substantial if the coordinates are converted from one format to the other.

If importing coordinates from a source where you are not sure if the units are in Feet or US Survey Feet into a job that is set to Feet or US Survey Feet, you will usually just want to import them without any conversion being performed. To do this, be sure to select the same distance units for the source file as those set for the current job.

HR: is the rod height.

☑ **With C.L.**: When checked, offset and stationing information from the selected centerline to the stake point is also provided in the DTM Shot screen.

Centerline...: will open the Select Line screen where an existing polyline can be selected that describes the centerline.

Store Point: is the starting point number if points are stored during the staking process. Future points are stored with the next available point names.

☑ **Generate TIN w\Staked Points**: will add any staked points to the TIN so the shape of the DTM can be viewed at any time in the 3D View screen and live cut / fill values can be viewed. When unchecked, the 3D View is unavailable and cut / fill values cannot be viewed, but are still stored to the raw data file.

Note: Viewing the DTM during DTM Stakeout is a useful quality assurance technique to determine where additional points are needed.

3D DTM: accesses the 3D View screen (Page R-64) where a 3D view of the DTM can be viewed from any angle.

Backsight: accesses the Backsight Setup screen (Page R-72) where the current backsight can be modified.

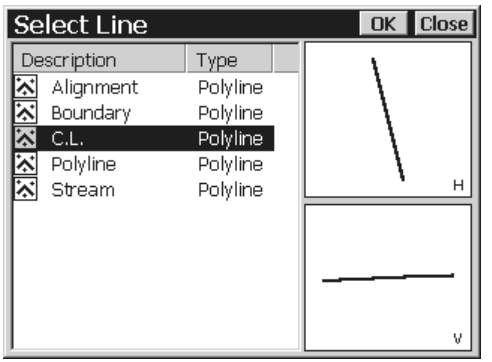
Solve: opens the DTM Shot screen where the DTM area can be staked.

Select Line

4 Stakeout | K Stake DTM | Solve

The Select Line screen is used to select a particular polyline. Separate overhead and side views are displayed on the right side of the screen for the selected polyline.

Simply select the desired line and tap OK.

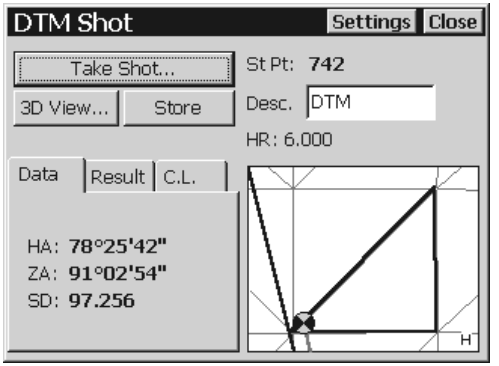


DTM Shot

4 Stakeout | K Stake DTM | Solve

The DTM Shot screen displays all relevant information on the current rod position and a graphic that shows the rod location, backsight, the occupied TIN triangle, and the rectangular DTM corners that encompass the DTM boundary.

Note: the DTM boundary corners and TIN triangle are not always visible depending on the current scale of the screen.



Take Shot...: triggers the total station to take a shot to the prism.

Note: You must be within the boundary of the DTM before any cut / fill information is provided.

3D View...: accesses the 3D View screen (Page R-64) where a 3D view of the DTM can be viewed from any angle as well as cut / fill information for the current location.

Note: The 3D View... button is only available when Generate TIN w\Staked Points is checked in the previous screen and at least three stake points have been stored.

Store: stores a point for the current rod location with the point name shown in the St Pt field and the description in the Desc field. Also advances the St Pt to the next available point name.

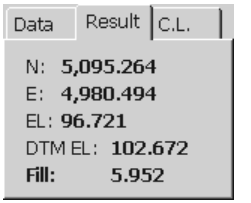
St Pt: is the point name that will be assigned to the next stored point.

Desc: is the description that will be assigned to the next stored point.

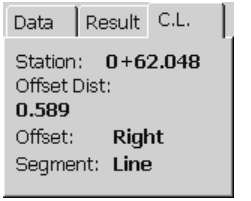
HR: is the height of the rod.

Data: shows the angle and distance information from the previous shot.

Result: shows the current northing, easting, and elevation of the rod as well as the computed elevation of the DTM at the current location and the cut or fill necessary to bring the elevation at the current location to the elevation of the DTM at the current location.



C.L.: shows the current station and offset information for the rod location relative to the centerline selected from the previous screen. The type of line segment in the polyline at the current station is also displayed. (This card is only available if the With C.L. checkbox was checked in the previous screen.)



Note: If the DTM EL and Cut / Fill fields are blank after taking a shot, it indicates the rod is outside the DTM boundary.

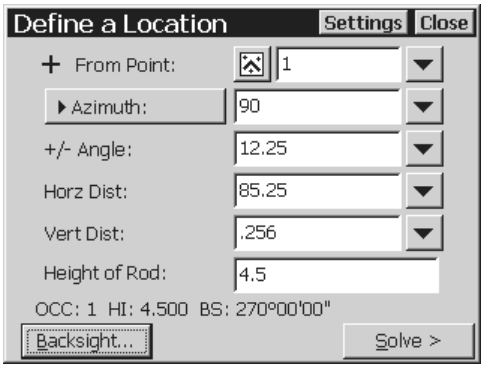
Note: Tapping anywhere within the map view will open a larger map view, which provides zoom controls.

Define a Location

3 Stakeout | L Define a Location

The Define a Location screen is used to manually enter the distance and direction to a new point from any existing reference point and then stakeout the new point.

From Point: is the reference point that the specified angle and distance information is applied to for locating the new point.



Azimuth / Bearing: is the direction from the reference point to the new point.

+/- Angle: is the angle to be added to the specified azimuth or bearing, thus modifying the direction to the new point.

Note: To subtract an angle from the specified azimuth or bearing, enter a negative +/- Angle value.

Horiz. Dist: is the horizontal distance from the reference point to the new point.

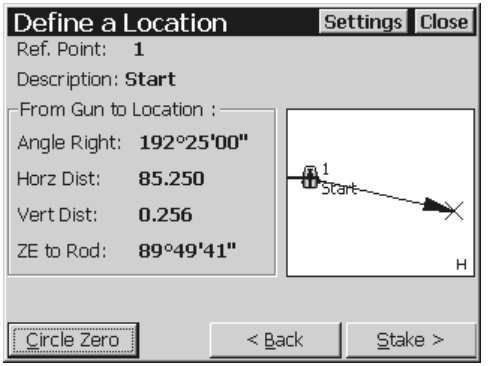
Vert. Dist: is the vertical distance from the reference point to the new point.

Store point: When this is checked, the computed point will be stored with the name specified here.

Solve: will compute the location for the new point and access the next screen.

Define a Location – Screen Two

The second Define a Location screen displays the direction and distance information from the occupy point to the new point.



Ref. Point: is the reference point specified in the From Point field in the previous screen.

Description: is the description for the reference point.

From Gun to Location: displays the angle and distance information from the total station to the new point. Users would aim their non-robotic total station the direction specified here.

Circle Zero: is used to modify the circle on the total station so that the angle right reading will be zero when it is facing toward the design point, which can sometimes be easier than turning to an obscure angle value. When this button is tapped, the following actions will occur:

1. A new backsight circle value is computed, sent to the instrument and stored in the raw data
2. The Angle Right value is changed to zero to reflect the change. The instrument now needs to be turned horizontally to zero to face the design point.
3. To prevent errors, the backsight set up is invalidated when exiting the Stakeout dialog if this button has been used. A Circle zeroed on a design point is meaningless once the design point has been staked.

< Back: returns to the previous screen.

Stake >: accesses the third Define a Location screen where the new point can be staked out.

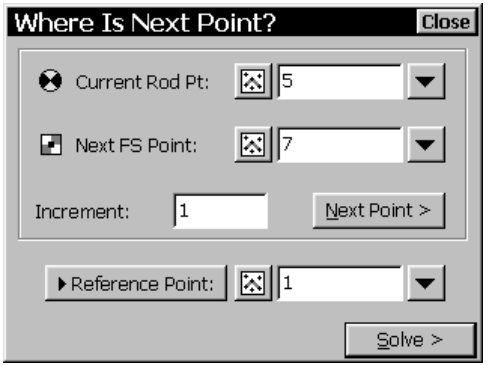
Note: The third Define a Location screen is identical to the third Stake Points screen, which is described on Page R-105.

Where is Next Point

4 Stakeout | M Where Is Next Point or

Ctrl-[S]

The Where is Next Point screen is used to assist the rod person in locating another point, given the current rod point, a reference point, and the point to locate.



Current Rod Pt: is the current rod point.

Next FS Point: is the point that the rod person wants to locate.

Increment: is added to the Next FS Point value after pressing the Next Point > button.

Next Point >: advances the Next FS Point value by the specified Increment, replaces the current rod point by the previous FS point, and accesses Screen Two.

Note: If the Next FS Point does not exist and the Increment value=1, pressing the Next Point button will access the next existing point. If the Increment is greater than one and the next point does not exist, a warning is displayed.

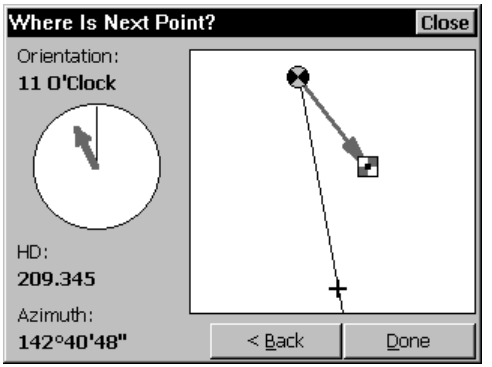
Reference Point / Reference Azm: is the reference point / azimuth used to determine the direction to the Next FS Point.

Solve >: computes the direction and distance to the Next FS Point and accesses the second screen.

Where is Next Point – Screen Two

This screen shows two graphics that indicate the direction and distance that the rod person must travel to reach the Next FS Point.

The clock-style graphic shows the current rod location at the center, a line in the 12 o'clock position indicates the direction to the Reference, and an arrow shows the direction to the Next FS Point. There is also a text indicator that explains the direction to travel in a clock format.



The second graphic is a map view that shows the Current Rod Point, the Reference and the Next FS Point. It also shows the Occupy Point if the backsight has been set.

The lower left portion of the screen displays the azimuth from the rod to the Next FS Point and the horizontal distance between them.

< Back: returns you to the first screen.

Done: closes the screen.

Inverse Menu

The Inverse Menu contains routines that compute the direction and distance between two objects. The following screens are available from the Inverse Menu:

A: Inverse Point to Point

B: Inverse Point to Line

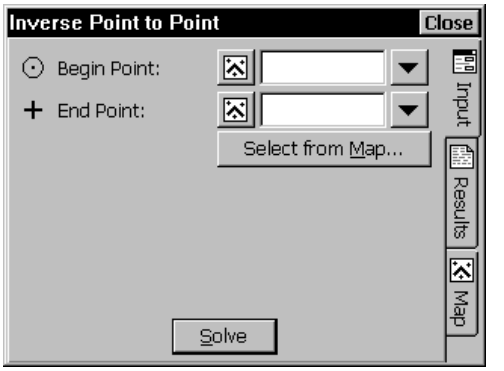
C: Inverse Point to Polyline

D: Inverse Point to Multiple Points

E: Inverse Point to Location / Point

Inverse Point to Point

5 Inverse | A Point to Point or Ctrl-[G]



The Inverse Point to Point screen will calculate the distance and direction between two existing points.

Begin Point: is the reference point used to compute the distance and direction to the End Point.

End Point: is the point whose relationship to the Begin Point is computed.

Select from Map...: allows you to quickly select both the Begin Point and End Point from a map view. The first point tapped is entered as the Begin Point and the second as the End Point.

Solve: will compute the distance and direction from the Begin Point to the End Point.

Results

Azimuth: is the azimuth from the Begin Point to the End Point.

Hor. dist: is the horizontal distance from the Begin Point to the End Point.

Vert. dist: is the vertical distance from the Begin Point to the End Point.

North: is the change in the Y-coordinate from the Begin Point to the End Point.

East: is the change in the X-coordinate from the Begin Point to the End Point.

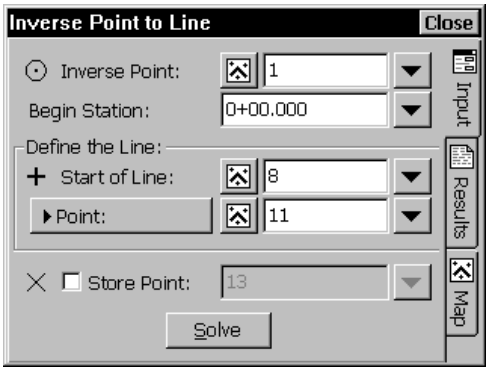
Elevation: is the change in elevation from the Begin Point to the End Point.

Grade: is the slope from the Begin Point to the End Point.

Inverse Point to Line

5 Inverse | B Point to Line

The Inverse Point to Line screen computes the perpendicular offset distance and direction from a known point to a continuous line defined by two points or one point and a direction.



Inverse Point: is the known point that the offset information to a specified line is computed.

Begin Station: is the beginning station value that corresponds with the Start of Line, which is used to compute the inverse station in the results.

Start of Line: is the first point that defines the line from which the offset is computed.

Point / Direction: is the second point or known direction that defines the line from which the offset is computed.

☑ **Store Point**: when checked, will store the coordinates for the point located on the specified line, tangent to the offset.

Solve: will compute the distance and direction of the offset from the known point perpendicular to the specified line.

Results

Inv. Station: is the station on the specified line where the perpendicular offset occurs, starting from the Begin Station.

Offset: is the horizontal distance of the perpendicular offset between the Inverse point and specified line.

Offset is: indicates if the Inverse point is located to the Right, Left, or on the specified line as you occupy Point 1 and face the second point or direction of the line.

Azimuth (pt to line): is the azimuth of the offset from the Inverse point toward the specified line.

North: is the Y-coordinate on the specified line, tangent to the perpendicular offset.

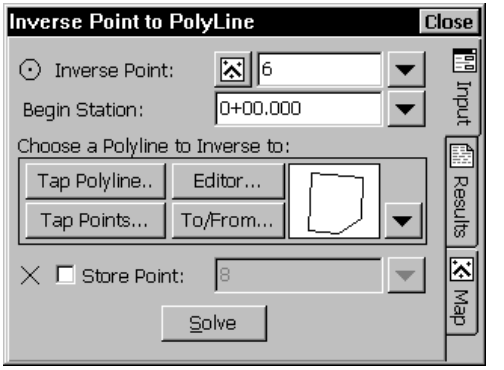
East: is the X-coordinate on the specified line, tangent to the perpendicular offset.

Elevation: is the elevation on the specified line, tangent to the perpendicular offset.

Inverse Point to Polyline

5 Inverse | C Point to Polyline

The Inverse Point to Polyline screen computes the offset distance from a known point perpendicular to a polyline.



Inverse Point: is the known point that the offset to a polyline segment is computed.

Begin Station: is the starting station assigned to the beginning of the polyline, which is used to compute the Station in the results.

Tap Polyline: allows you to tap an existing polyline from a map view.

Editor: accesses the Polyline Editor (Page R-45) where a new polyline can be created or an existing polyline can be modified.

Tap Points: provides a map view where you can tap any existing points to create a temporary polyline.

To/From: provides point selection by entering point names.

☑ **Store Point**: when checked, will store the first solution where a perpendicular offset intersects with a polyline using the specified point name. If additional solutions are found, the following solutions will be stored using consecutive point names.

Solve: will compute the distance and direction of the offset from the known point perpendicular to the polyline.

Note: There is no solution if a perpendicular offset does not occur within the extents of any selected polyline segments.

Results

Station: is the station along the polyline where the offset occurs, starting from the Begin station.

Offset: is the horizontal distance of the offset.

Offset is: indicates if the Inverse Point is located to the right, left, or on the specified line as you occupy the beginning of the polyline and face the end.

Segment Type: shows if the segment is a line, arc, or spiral.

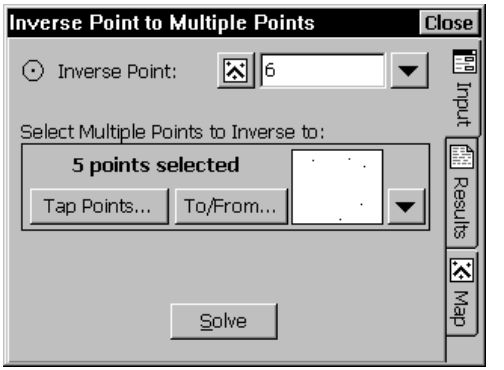
Beg. Pt: if applicable, this is the first point selected that defines a line.

End Pt: if applicable, this is the second point selected that defines a line.

Inverse Point to Multiple Points

5 Inverse D Multiple Points

The Inverse Point to Multiple Points screen will calculate the distance and direction from an existing point to one or more other points.



Inverse point: is the reference point used to compute the distance and direction to the other points.

Tap Points: provides a map view where you can tap multiple points.

To/From: provides selection of points by point name.

Solve: will compute the distance and direction from the Inverse point to all selected points.

Results

Azimuth: is the azimuth from the Inverse Point to the selected point.

Hor. dist: is the horizontal distance from the Inverse Point to the selected point.

Vert. dist: is the vertical distance from the Inverse Point to the selected point.

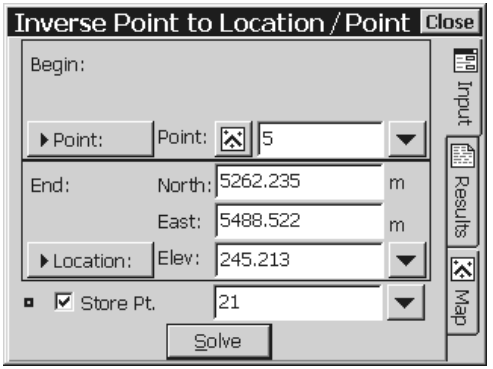
North: is the change in the Y-coordinate from the Inverse Point to the selected point.

East: is the change in the X-coordinate from the Inverse Point to the selected point.

Inverse Point to Location / Point

5 Inverse E Location / Point

The Inverse Point to Location / Point screen will calculate the distance and direction from any point or location to another point or location.



Begin: is the reference point or location used to compute the distance and direction to another point or location.

End: is the other point or location whose correlation to the Begin point or location is computed. Each location is defined by one of the following methods:

- Location: : when selected, the coordinates for any location can be entered in the appropriate fields.
- Point: : when selected, any existing point name can be entered in the appropriate field or selected from a map view.

☑ **Store Pt.**: when checked, will store a point for the location(s) entered.

Solve : will compute the distance and direction from the Begin point or location to the End point or location.

Cogo Menu

The Cogo Menu contains all of the coordinate geometry routines used to perform computations from the existing job data. The following screens are available from the Cogo Menu:

A: Point in Direction

B: Intersection

C: Offset Line

D: Offset Points

E: Corner Angle

F: Compute Area

G: Triangle Solutions

H: Map Check

I: Predetermined Area

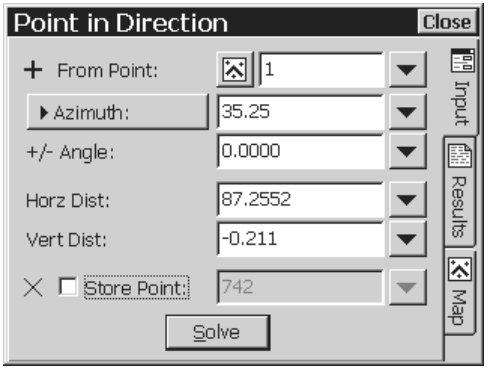
J: HD/VD to SD/ZA

K: SD/ZA to HD/VD

Point in Direction

6 Cogo A Point in Direction

The Point in Direction screen will calculate and store the position of a new point after providing a distance and direction from a known point.



From point: is the point name of the reference point used for locating the new point.

Azimuth / Bearing: is the direction from the reference point to the new point.

+/- Angle: is the angle added to the Azimuth / Bearing to modify the direction to the new point.

Note: To subtract an angle from the specified azimuth or bearing, enter a negative +/- Angle value.

Horiz. Dist: is the horizontal distance from the reference point to the new point.

Vert. Dist: is the vertical distance from the reference point to the new point.

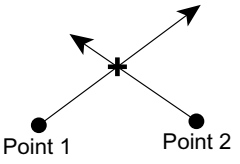
Store point: When this is checked, the computed point will be stored with the name specified here.

Solve: will compute the location for, and optionally store the new point.

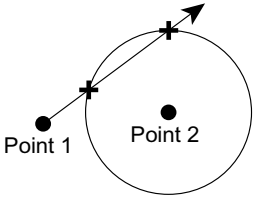
Intersection

6 Cogo | B Intersection

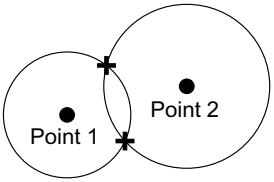
The Intersection screen computes, and optionally stores, the coordinates for the intersection of two lines, where the lines are tangent to existing points. Each line is independently defined by a known direction or a known length. (See illustration below.)



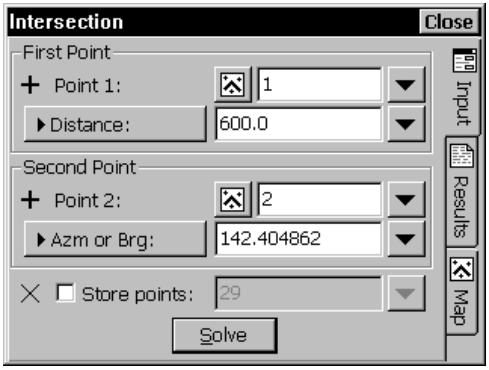
Direction - Direction Intersection



Direction - Distance Intersection



Distance - Distance Intersection



Point 1: is an existing point that is tangent to the first line.

Point 2: is an existing point that is tangent to the second line.

Distance / Azm or Brg: is the length or direction, respectively, of the specific line.

☑ **Store point**: when checked, is the point name used when storing the intersection(s) of the two lines. If two intersections occur, the second solution is stored using the next consecutive point name.

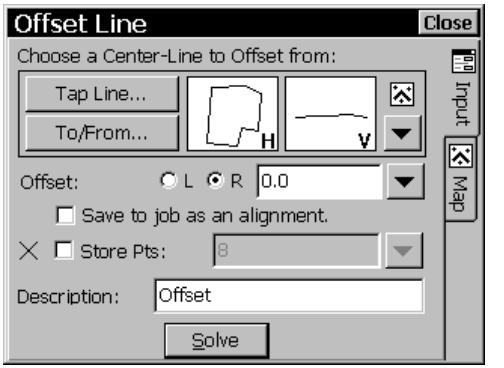
Solve: will compute the intersecting point, optionally store the point and display the information in the Map view.

Offset Line

6 Cogo | C Offset Line

The Offset Line screen is used to store points or an alignment that is parallel to an existing set of points, a polyline, or an alignment, at a specified perpendicular offset.

Note: When storing points, the number of new points stored will equal the number of points in the selected polyline or point range. If the offset is from an alignment, the number of points stored will equal the number of nodes that occur in the horizontal portion of the alignment.



Tap Line... : allows you to tap an existing polyline or alignment that the offset will be computed from.

To/From... : allows you to enter a range of points that define the line where the offset will be computed from.

Offset: defines the offset distance and which side the offset occurs. The right or left side is referenced from the first point that defines the specified line.

☑ **Save to job as an alignment**: when checked, the computed offset line will be saved as a new alignment under the name specified in the Description field.

Note: Spiral curves cannot be generated in a new offset alignment. If the original centerline contains any spiral curves, they will be treated as straight sections in the offset alignment that is created. The Offset Staking or Offset Points routine should be used to stake offsets from a spiral curve.

☑ **Store Pts**: when checked, is the first point name that will be used when storing the computed offset points. Additional points will automatically be assigned with the next consecutive point name, such as 8, 9, 10… or Offset, Offset2, Offset3…

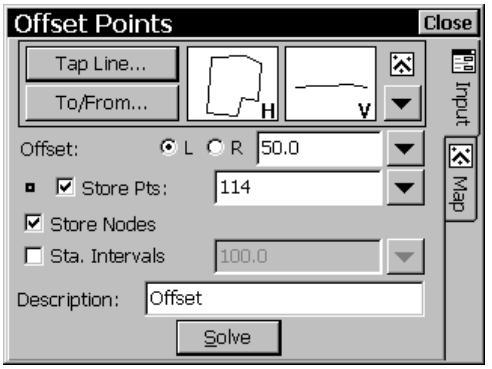
Description: is the description that will be assigned to the new points that are generated or to the new alignment.

Solve: computes and stores the new offset points and polyline.

Offset Points

6 Cogo | D Offset Line

The Offset Points screen is used to store points at a specified perpendicular offset to an existing polyline, alignment, or point range. Points can be stored that correspond with the nodes of an alignment, points of a polyline, and/or at a specified station interval.



Tap Line...: allows you to tap an existing polyline or alignment that the offset points will be computed from.

To/From...: allows you to enter a range of points that define the line where the offset will be computed from.

Offset: defines the offset distance and which side the offset occurs. The right or left side is referenced from the first point that defines the selected line.

☑ **Store Pts**: when checked, will store the offset points that are computed based on the selected line and which of the two following checkboxes are checked.

Note: Leaving the Store Pts field unchecked and solving the screen will result in a map screen that displays the points that would be stored, but without actually storing anything to the job. This is useful for testing the routine before storing information.

☑ **Store Nodes**: when checked, computes offset points that correspond to each node in the selected alignment (points where the horizontal or vertical alignment change), or that correspond to the existing points in a selected line or point range.

☑ **Sta. Intervals**: when checked, computes offset points from the beginning of the selected line or point range, and at each specified station interval along the line or point range.

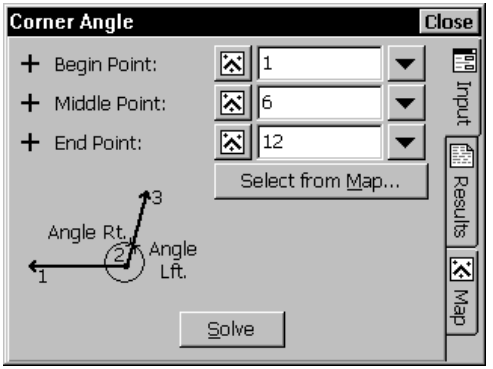
Description: is the description that will be assigned to all points that are stored.

Solve: computes the offset points, and stores them if the Store Pts checkbox is checked.

Corner Angle

6 Cogo | E Corner Angle or Ctrl-[H]

The Corner Angle screen provides information on the horizontal angle created from three known points.



Backsight: is an end point of the angle to be solved.

Middle Point: is the corner point of the angle to be solved.

Foresight Point: is the other end point of the angle to be solved

Select from Map...: Allows you to quickly select all of the above points from a map view. The first point tapped is entered in the Backsight field, the second in the Middle Point field and the third point tapped is entered in the End Point field.

Solve: will compute the following results that describe the angle defined by the three points provided.

Results

Angle left: is the horizontal angle created as you occupy the Middle Point, face the Backsight, and turn counterclockwise to the Foresight Point.

Angle right: is the horizontal angle created as you occupy the Middle Point, face the Backsight, and turn clockwise to the Foresight Point.

180 – right: is the angle that results from subtracting the angle right value from 180°.

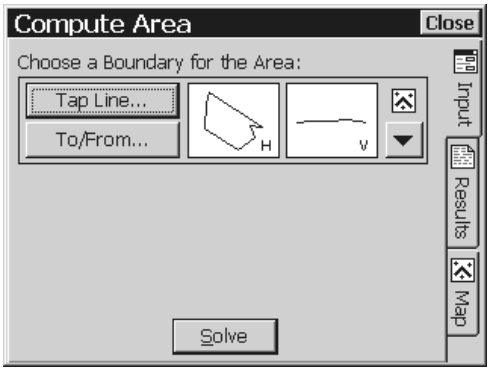
HD to Beg.: is the horizontal distance between the Backsight and the Middle Point.

HD to End: is the horizontal distance between the Foresight Point and the Middle Point.

Compute Area

6 Cogo F Compute Area

Allows you to compute the area of a selected boundary.



Tap Line...: allows you to tap an existing polyline from a map view.

To/From...: provides selection of points by point name.

Solve: will compute the area of the selected boundary.

Results

Area: is the area that the boundary encloses. If the boundary is not closed, the area is computed as if a line joined the two ends.

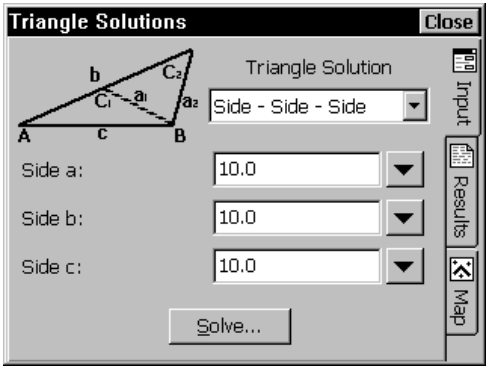
Length: is the length of the selected boundary.

Perimeter: is the length of the selected boundary, plus any additional length between the two ends of an open boundary.

Triangle Solutions

6 Cogo | G Triangle Solutions or Ctrl-[I]

The Triangle Solutions screen will solve for the unknown parts of a triangle after providing three known parts.



Triangle Solution: is where you select the parts of the triangle that are known. You can select any of the following from the dropdown list:

- **Side-Side-Side**: The lengths of all three sides are known.
- **Angle-Side-Angle**: Two angles and the side between them are known.
- **Side-Angle-Angle**: Two angles and one side (that does not lie between those angles) are known.
- **Side-Angle-Side**: Two sides and the angle between them are known.
- **Side-Side-Angle**: Two sides and one angle (that is not between those sides) are known.

Solve... will solve for the unknown parts of the triangle.

Results

Side a / **b** / **c**: displays the length of each side.

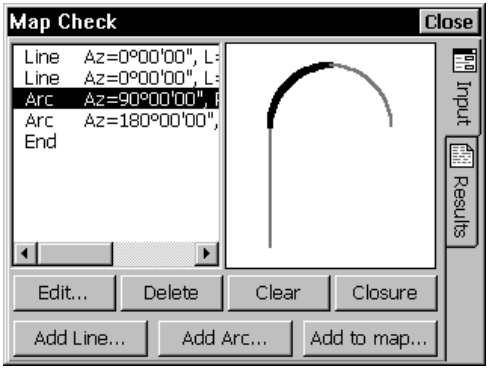
Angle A / **B** / **C**: displays the corresponding angle.

Area: displays the area of the triangle in square feet and acres, or in square meters and hectares.

Map Check

6 Cogo H Map Check

The Map Check screen is used to manually enter boundaries from a map to check for closure and other information related to the boundary.



Edit...: accesses the appropriate editor screen where you can edit the selected line or curve from the list.

Delete: deletes the selected line segment.

Clear: clears all line entries.

Closure: accesses the Results page.

Add Line...: accesses the Add / Edit Line screen, (Page R-165), where a new line can be added prior to the select segment.

Add Arc...: accesses the Add / Edit Curve screen (Page R-165) where a new curve can be added prior to the selected segment.

Add to Map...: accesses the Add to Map screen (Page R-166) where the map data entered in the list can be added to the current job as a polyline.

Results

Area: is the area that the boundary encloses. If the start and end points are in different locations, the area is computed as if a line joined these two points.

Length: is the length of the boundary from the first point to the last point.

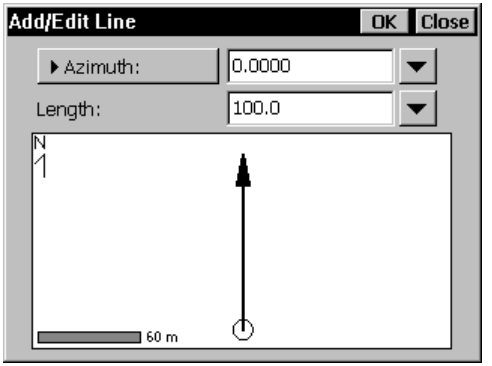
Perimeter: is the length of the boundary from the first point to the last point, plus any additional length between the last point and the first point.

Error dist.: is the distance between the last point and the first point.

Error azm: is the direction from the last point to the first point

Precision: is the ratio between the Error distance and Perimeter.

Add / Edit Line



The Add / Edit Line screen is used to enter a new line to the list prior to the selected line segment.

[Azimuth] / [Bearing]: is the direction of the line.

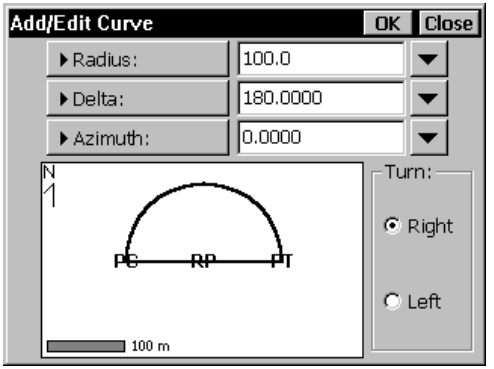
Length: is the length of the line, in feet or meters.

[OK]: enters the line to the list.

[Cancel]: closes the screen without entering any new line data.

Add / Edit Curve

The Add / Edit Curve screen is used to enter a new curve to the list prior to the selected line segment.



[Radius]: The distance from the radius point to the curve

[Delta]: The internal angle from center to tangent points

[Degree Arc]: The internal angle equivalent to a 100-ft arc length

[Degree Chord]: The internal angle equivalent to a 100-ft chord length

[Length]: The arc length

[Chord] : The chord length

Tangent: The distance from the PC or PT to the PI

Mid Ordinate: The distance between the curve and the chord at the center of the curve's length.

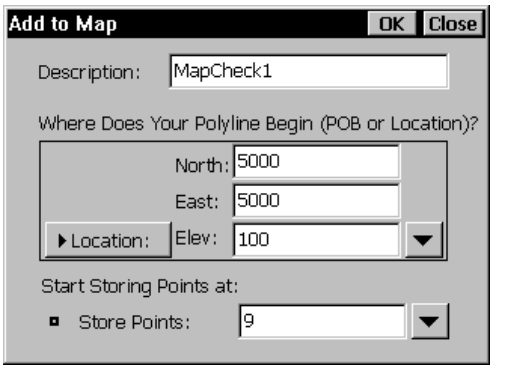
Azimuth / Bearing: defines the direction of the curve, tangent at the PC.

Turn: defines if the curve turns to the Left or Right while viewing the curve from the PC Point.

OK: appends the curve to the list.

Add to Map

The Add to Map screen is used to add the existing line and curve data to the current job as a polyline.



Description: is the name that will be assigned to the new polyline that will be added to the project.

Location: can be used to manually enter the coordinates for the first point of the polyline.

Point: can be used to define the starting location of the first point of the polyline by an existing point.

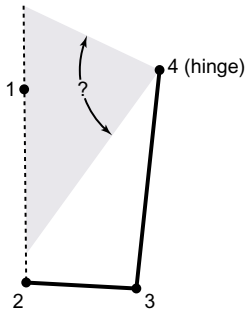
Store Points: is the first point name that will be used for the new points that are needed to add the figure to the current job. All additional points will be incremented from this point.

OK: adds the figure to the job at the specified location.

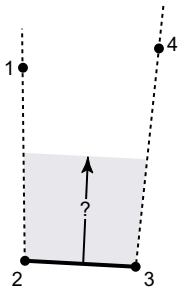
Cancel: closes the screen without adding any new data to the job.

Predetermined Area

6 Cogo | I Predetermined Area



Hinge Method



Parallel Method

The Predetermined Area routine will take a boundary with one open side and compute the location of a line that will enclose the boundary with a specified area using the Hinge Method or the Parallel Method.

The Hinge Method computes the location of the side of a boundary that can pivot on a fixed point.

The Parallel Method computes the location of one side of a four-sided boundary where the computed side is parallel to a stationary side of the boundary.

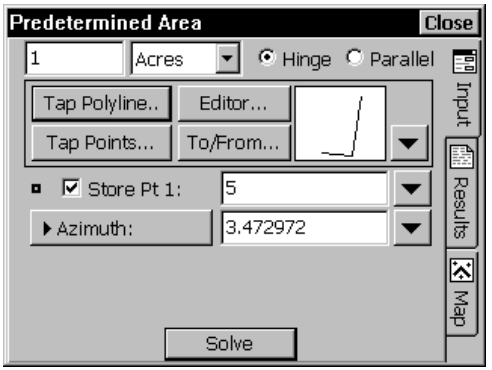
The top-left field is used to enter the desired area of the specified boundary. In the next field, select the units entered from the dropdown list.

Hinge: solves the boundary using the Hinge Method when selected.

Parallel: solves the boundary using the Parallel Method when selected.

Tap Polyline...: allows you to tap an existing polyline from a map view to define the fixed sides of the boundary.

Note: a boundary has two fixed sides and one side defined by a direction when using the Hinge Method. It has one fixed side and two sides defined by a direction when using the Parallel Method.



Editor...: accesses the Polyline Editor (Page R-45) where a new polyline can be created or an existing polyline can be modified.

Tap Points...: provides a map view where you can tap any existing points to define the fixed sides of the boundary.

To/From...: provides point selection by entering point names.

☑ **Store Pt 1** / **2**: when checked, will store a point at the location of the end point(s) of the computed boundary line.

▸ Azimuth / ▸ Bearing: defines the direction of the boundary sides with lengths that are not yet known.

Results

Point 1 / **2**: Displays the coordinate of the end points of the computed boundary line.

Total Area: is the total area of the boundary.

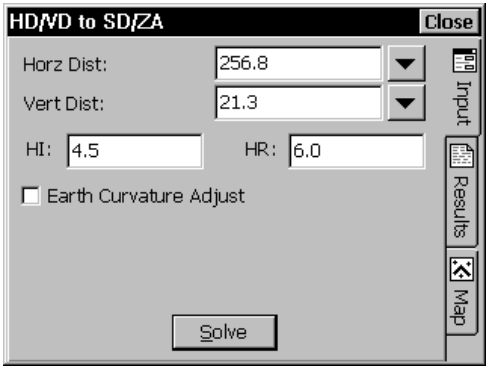
Plot Area: is the area enclosed by the pre-defined fixed boundary lines.

Difference: is the difference between the Total Area and the Plot Area.

HD/VD to SD/ZA

6 Cogo | J HD/VD to SD/ZA

The HD/VD to SD/ZA screen will convert a vertical and horizontal distance to an equivalent slope distance and zenith angle.



Horz Dist: is the horizontal distance from the occupy point to the foresight point.

Vert Dist: is the vertical distance from the occupy point to the foresight point.

HI: is the distance that the total station is above the ground.

HR: is the length of the rod.

☑ **Earth Curvature Adjust**: when checked, the resulting zenith angle and slope distance will account for the curvature of the earth and refraction.

Solve: computes the equivalent slope distance and zenith angle from the data entered.

Results

Zenith: is the computed zenith angle from the occupy point to the foresight point.

Slope Dist: is the computed slope distance from the occupy point to the foresight point.

SD/ZA to HD/VD

6 Cogo | K SD/ZA to HD/VD

The SD/ZA to HD/VD screen will convert a slope distance and zenith angle to an equivalent horizontal distance and vertical distance.

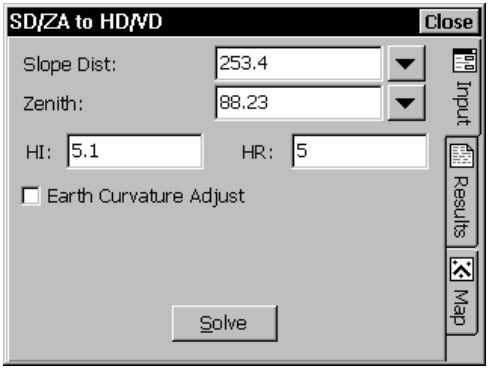
Slope Dist: is the slope distance to be converted.

Zenith: is the zenith angle to be converted.

HI: is the distance that the total station is above the ground.

HR: is the length of the rod.

☑ **Earth Curvature Adjust**: when checked, the computed horizontal distance and vertical distance will account for the curvature of the earth and refraction.



Curve Menu

The Curve Menu contains routines that will compute all aspects of a horizontal curve and assist in curve layout.

A: Curve Solution

B: PI and Tangents

C: 3-Point Curve

D: Radius Point

E: Tangent to Circle

F: Curve Layout

G: Traverse on Curve

H: Parabolic Curve

I: Parabolic Layout

J: Straight Grade

K: Spiral

L: Spiral Layout

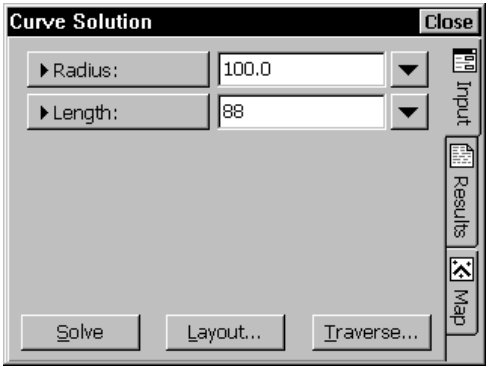
M: Traverse on Spiral

Curve Solution

7 Curve | A Curve Solution or Ctrl-[**M**]

The Curve Solution screen provides detailed information on a curve when two parts of the curve are known.

The first known part of the curve is defined by one of the following:



- Radius: is the distance from the radius point to the curve.
- Delta: is the deflection angle.
- Degree Arc: is the deflection angle that results in a 100-ft. arc length.
- Degree Chord: is the deflection angle that results in a 100-ft. chord length.

The second known part of the curve is defined by one of the following:

- Delta: is the deflection angle.
- Length: is the arc length.
- Chord: is the chord length.
- Tangent: is the distance from the PC or PT to the PI.
- Mid Ordinate: is the distance between the curve and the chord at the center of the curve's length.

Solve: Computes the details for the horizontal curve.

Layout...: Accesses the Horizontal Curve Layout screen (Page R-177) where points can be created so the curve can be staked in the field.

Traverse...: Accesses the Traverse on Curve screen (Page R-184).

Results:

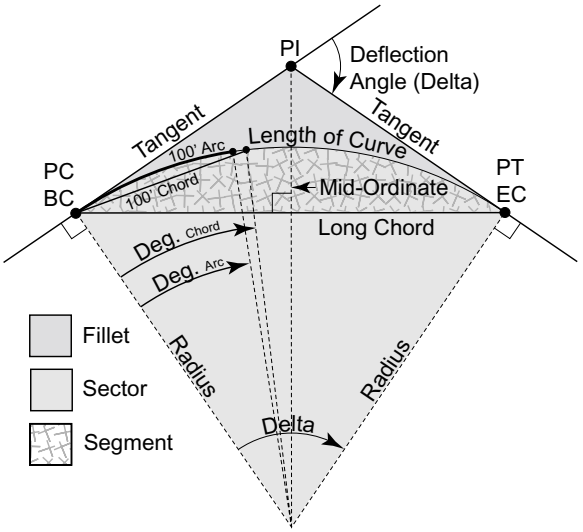
Radius: is the distance from the radius point to the curve.

Length: is the arc length.

Chord: is the chord length.

Deg. Arc: is the deflection angle that results in a 100-ft. arc length.

Deg. Chord: is the deflection angle that results in a 100-ft. chord length.



Delta: is the deflection angle.

Tangent: is the distance from the PC or PT to the PI.

External: is the minimum distance between the PI and the curve.

Mid Ord.: is the distance between the curve and the chord at the center of the curve's length.

Segment: is the area between the arc length and the chord.

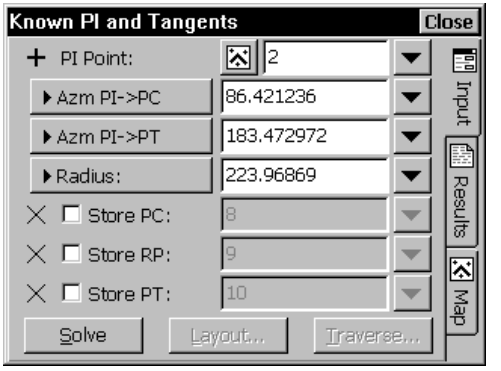
Sector: is the area between the arc length and the two edge radii.

Fillet: is the area between the arc length and the tangents.

Known PI and Tangents

7 Curve | B PI and Tangents

The PI and Tangents screen is used to compute and store the PC, PT, and radius points when the PI point and the direction of both tangents are known, along with one other curve attribute.



PI Point: is the PI point.

Azm PI->PC / Brg PI->PC: is the direction of the tangent from the PI to the PC.

Azm PI->PT / Brg PI->PT: is the direction of the tangent from the PI to the PT.

The remaining curve attribute can be defined with one of the following selections:

- Radius: is the distance from the radius point to the curve.
- Delta: is the deflection angle.
- Degree Arc: is the deflection angle that results in a 100-ft. arc length.
- Degree Chord: is the deflection angle that results in a 100-ft. chord length.

☑ **Store PC**: when checked, will store the computed PC point with the specified point name.

☑ **Store RP**: when checked, will store the computed radius point with the specified point name.

☑ **Store PT**: when checked, will store the computed PT point with the specified point name.

Results:

Radius: is the distance from the radius point to the curve.

Delta: is the deflection angle.

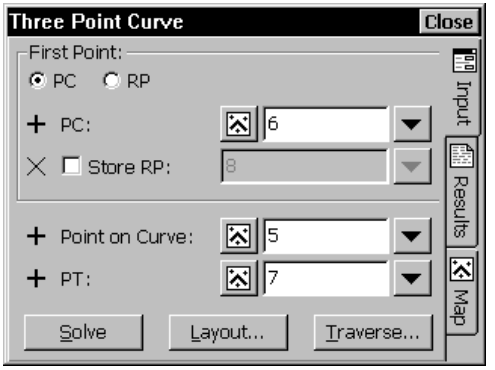
Tangent: is the distance from the PC or PT to the PI.

Three Point Curve

7 Curve | C 3 Point Curve

The Three Point Curve screen will compute the details of a curve when three points of the curve are specified; the PC, PT and any other point on the curve; or the PC, PT and radius point.

First point: is the first point from the current job that defines the curve. The specified point can be either the PC or the Radius Point by selecting the appropriate radio button.



Note: The selection made for the first point determines the available choices in the remaining fields.

Pt. on Curve: is any point that lies on the curve between the PC and PT.

PC: is the point that defines the beginning of the curve (Point of Curvature).

PT: is the point that defines the end of the curve (Point of Tangency).

☑ **Store RP**: when checked, the radius point will be computed and stored with the name specified here.

Solve: will compute the curve based on the selected points.

Traverse: accesses the Traverse on Curve screen (Page R-184), where the curve can be included in a traverse.

Layout: accesses the Curve Layout screen (Page R-177), where the location of points on a curve can be computed at any station interval.

Results:

Radius: is the distance from the radius point to the curve.

Length: is the arc length.

Chord: is the chord length.

Delta: is the deflection angle.

Tangent: is the distance from the PC or PT to the PI.

Mid Ord.: is the distance between the curve and the chord at the center of the curve's length.

External: is the minimum distance between the PI and the curve.

Deg. Arc: is the deflection angle that results in a 100-ft. arc length.

Deg. Chord: is the deflection angle that results in a 100-ft. chord length.

Segment: is the area between the arc length and the chord.

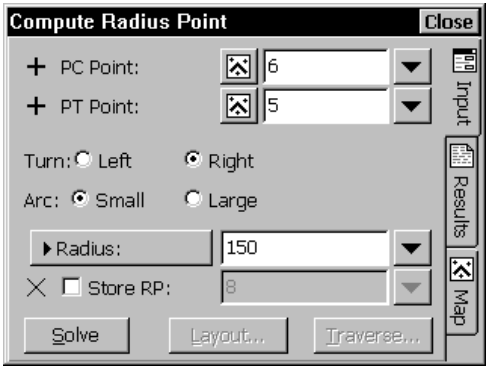
Sector: is the area between the arc length and the two edge radii.

Fillet: is the area between the arc length and the tangents.

Compute Radius Point

7 Curve | D Radius Point

The Compute Radius Point screen is used to compute and optionally store the radius point for a curve when certain parts of the curve are known.



PC Point: is the point that defines the beginning of the curve (Point of Curvature).

PT Point: is the point that defines the end of the curve (Point of Tangency).

Turn: specifies if the curve turns to the Left or Right as you face the curve from the PC.

Arc: specifies if the arc is Small (less than 180°) or Large (greater than 180°).

The final part of the curve is defined by one of the following choices:

- Radius: is the distance from the radius point to the curve.
- Delta: is the deflection angle.
- Degree Arc: is the deflection angle that results in a 100-ft. arc length.
- Degree Chord: is the deflection angle that results in a 100-ft. chord length.

☑ **Store RP**: when checked, the computed radius point will be stored with the name specified here.

Solve: computes the location of the radius point.

Layout...: accesses the Curve Layout screen (Page R-179).

Traverse...: accesses the Traverse On Curve screen (Page R-184).

Results

Radius: is the distance from the radius point to the curve.

Length: is the arc length.

Chord: is the chord length.

Deg. Arc: is the deflection angle that results in a 100-ft. arc length.

Deg. Chord: is the deflection angle that results in a 100-ft. chord length.

Delta: is the deflection angle.

Tangent: is the distance from the PC or PT to the PI.

External: is the minimum distance between the PI and the curve.

Mid Ord.: is the distance between the curve and the chord at the center of the curve's length.

Segment: is the area between the arc length and the chord.

Sector: is the area between the arc length and the two edge radii.

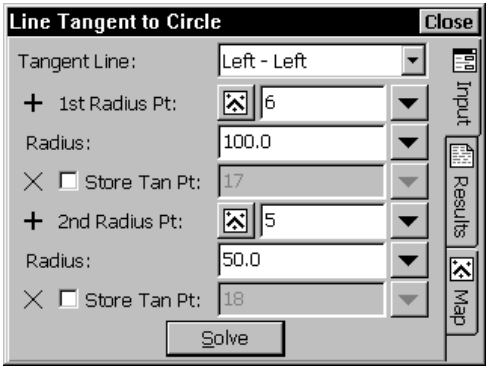
Fillet: is the area between the arc length and the tangents.

Line Tangent to Circle

7 Curve | E Tangent to Circle

Will compute the location of a line that is tangent to the specified sides of two specified circles.

Tangent Line: determines which sides of the circles the computed line will be tangent to as you occupy the 1st Radius Point and face the 2nd Radius Point. (See illustration below.)

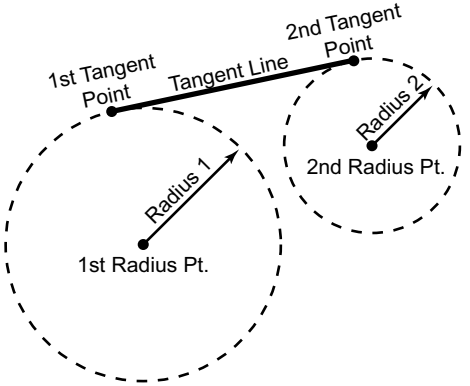


1st / **2nd Radius Pt**: defines the points around which the circles are computed.

Radius: defines the radius of the circles that are used to compute the Tangent Line.

☑ **Store Tan Pt**: when checked, will store the computed tangent points.

Solve: computes the location of the tangent line and optionally stores the two tangent points.



Line Tangent to Circles solution illustrating the location of a **Left-Left** Tangent Line.

Results

TP 1: displays the coordinates for the first tangent point.

TP 2: displays the coordinates for the second tangent point.

Azimuth: is the azimuth of the tangent line from the first tangent point to the second.

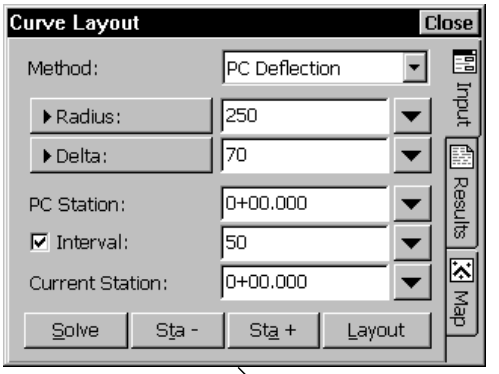
Distance: is the length of the tangent line.

Horizontal Curve

Layout

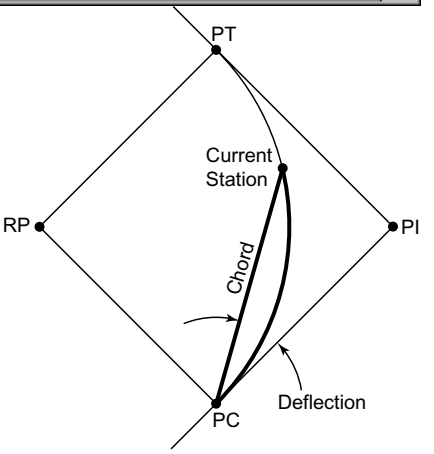
7 Curve | F Horiz. Layout

The Horizontal Layout screen is used to assist in the layout of a horizontal curve by computing the direction and distance to points on the curve using a variety of methods.

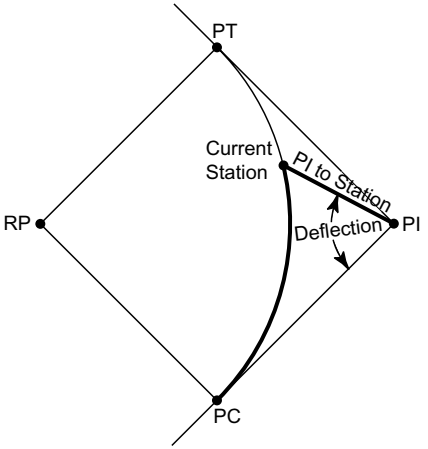


Method: The method determines how the points on the curve are laid out. Each method is described below.

- **PC Deflection**: provides deflection angles and distances to each station on the curve as if occupying the PC and backsighting the PI. The results are given in the following format:
  - **Station**: is the current station on the curve.
  - **Deflection**: is the angle to turn to the current station.
  - **Long chord**: is the distance from the PC to the current station.
  - **Short chord**: is the distance from the previous station to the current station.

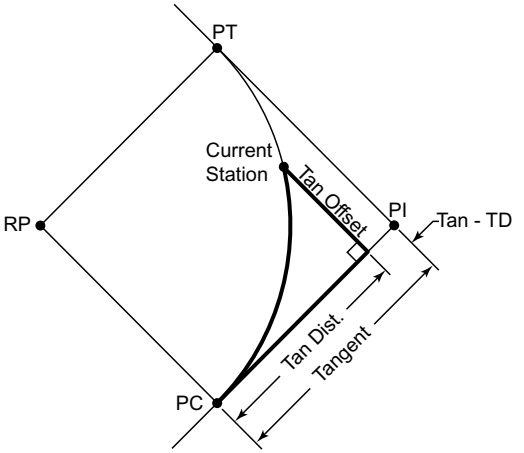


PC Deflection



PI Deflection

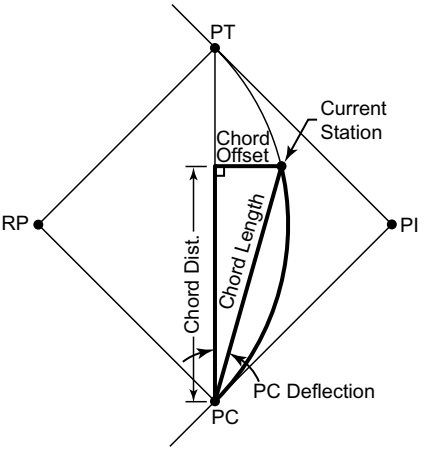
- **PI Deflection**: provides deflection angles and distances to each station on the curve as if occupying the PI and backsight the PC. The results are given in the following format:
  - **Station**: is the current station on the curve.
  - **Deflection**: is the angle to turn to the current station.
  - **PI to Station**: is the distance from the PI to the current station.



Tangent Offset

- **Tangent Offset**: provides perpendicular offset information from the tangent (the line from the PC to the PI) for each station on the curve. The results are given in the following format:
  - **Station**: is the current station on the curve
  - **Tan dist (TD)**: is the distance on the tangent, from the PC to the PI, or the PI to the PT, where the perpendicular offset occurs.
  - **Tan offset**: is the distance, perpendicular to the tangent, to the curve at the particular station.
  - **Tan**: is the length of the tangent (the distance from the PC to the PI).
  - **Tan – TD**: is the distance on the tangent, from the PI to the PC, or the PI to the PT, where the offset occurs

- **Chord Offset**: provides perpendicular offset information from the chord (the line from the PC to the PT) for each station on the curve. PC deflection information is also provided. The results are given in the following format:
  - **Station**: is the current station on the curve.
  - **Chord dist.**: is the distance on the long chord from the PC (toward the PT) where the perpendicular offset occurs.
  - **Chord offset**: is the distance to the current station on the curve, perpendicular to the long chord.
  - **PC Deflection**: is the angle to turn to the current station, as if occupying the PC and backsighting the PI.
  - **Chord Length**: is the distance from the PC to the current station on the curve.



Chord Offset

The first known part of the curve is defined by one of the following:

- Radius: is the distance from the radius point to the curve.
- Delta: is the deflection angle.
- Degree Arc: is the deflection angle that results in a 100-ft. arc length.
- Degree Chord: is the deflection angle that results in a 100-ft. chord length.

The second known part of the curve is defined by one of the following:

- Delta: is the deflection angle.
- Length: is the arc length.
- Chord: is the chord length.
- Tangent: is the distance from the PC or PT to the PI.

- Mid Ordinate: is the distance between the curve and the chord at the center of the curve's length.

PC Station: is the starting station assigned to the PC.

☑ **Interval**: when checked, all necessary information for each station at the specified interval on the curve will be computed.

Start station: when not computing by interval (above), only the information for the particular station entered here is computed.

Solve: will solve and display all the details of the specified curve, without the layout information.

Sta -: decreases the current station by the station interval.

Sta +: increases the current station by the station interval.

Layout: will solve and display the layout information for all the stations of the specified curve.

Results

Radius: is the distance from the radius point to the curve.

Length: is the arc length.

Chord: is the chord length.

Delta: is the deflection angle.

Tangent: is the distance from the PC or PT to the PI.

Mid Ord.: is the distance between the curve and the chord at the center of the curve's length.

External: is the minimum distance between the PI and the curve.

Deg. Arc: is the deflection angle that results in a 100-ft. arc length.

Deg. Chord: is the deflection angle that results in a 100-ft. chord length.

Segment: is the area between the arc length and the chord.

Sector: is the area between the arc length and the two edge radii.

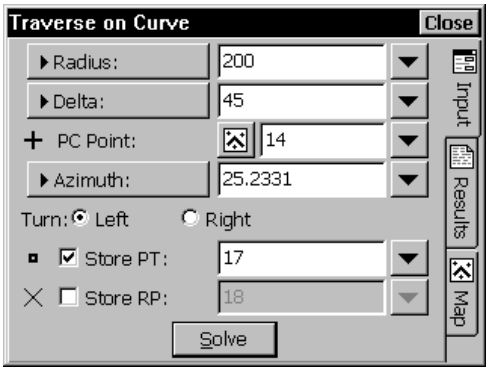
Fillet: is the area between the arc length and the tangents.

Traverse on Curve

7 Curve | G Trav. on Curve

The Traverse on Curve screen will compute the PT and radius point for a curve when the tangent azimuth at a PC point is known.

The first known part of the curve is defined by one of the following:



- Radius: is the distance from the radius point to the curve.
- Delta: is the deflection angle.
- Degree Arc: is the deflection angle that results in a 100-ft. arc length.
- Degree Chord: is the deflection angle that results in a 100-ft. chord length.

The second known part of the curve is defined by one of the following:

- Delta: is the deflection angle.
- Length: is the arc length.
- Chord: is the chord length.
- Tangent: is the distance from the PC or PT to the PI.
- Mid Ordinate: is the distance between the curve and the chord at the center of the curve's length.

PC Point: is the point that defines the beginning of the curve (Point of Curvature).

Azimuth / Bearing: is the direction of the tangent at the beginning of the curve.

Turn: specifies if the curve turns to the Left or Right as you face the curve from the PC.

☑ **Store PT**: when checked, will store the computed PT point with the specified point name.

☑ **Store RP**: when checked, the computed radius point will be stored with the name specified here.

Solve: will compute and store the PT, and if desired, the radius point.

Results

Radius: is the distance from the radius point to the curve.

Length: is the arc length.

Chord: is the chord length.

Delta: is the deflection angle.

Tangent: is the distance from the PC or PT to the PI.

Mid Ord.: is the distance between the curve and the chord at the center of the curve's length.

External: is the minimum distance between the PI and the curve.

Deg. Arc: is the deflection angle that results in a 100-ft. arc length.

Deg. Chord: is the deflection angle that results in a 100-ft. chord length.

Segment: is the area between the arc length and the chord.

Sector: is the area between the arc length and the two edge radii.

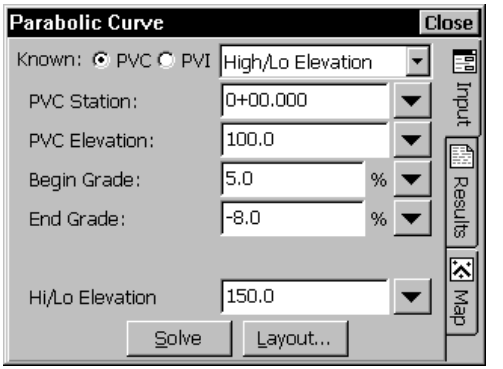
Fillet: is the area between the arc length and the tangents.

Parabolic Curve

7 Curve | H Parabolic Curve or

Ctrl-[N]

The Parabolic Curve screen provides detailed information on a vertical parabolic curve when certain parts of the curve are known.



Known: The PVC or PVI radio button is selected to define which point on the curve is known.

One of the following options must be selected from the dropdown list:

- **Curve Length**: is selected when the length of the curve is known. When selected the following must also be specified:
  - **Curve length**: is the length of the vertical curve (the horizontal distance between the PVC and PVT).
- **Point On Curve**: is selected when the location of another point on the curve is known. When selected, the following must also be specified.
  - **Station**: is the station where the other point is located on the curve.
  - **Elevation**: is the elevation of the other point.
- **Hi/Lo Elevation**: is selected when the high or low point for the curve is known. When selected, the following must also be specified.
  - **Hi/Lo Elevation**: is the elevation of the curve at the location where the tangent is zero (the crest of the curve).

Note: When the begin and end grades are both positive or both negative, the high / low elevation will not be located between the PVC and PVT.

PVC / **PVI Station**: is the station for the specified point.

PVC / **PVI Elevation**: is the elevation for the specified point.

Begin Grade: is the grade at the tangent of the PVC.

End Grade: is the grade at the tangent of the PVT.

Solve: computes the details for the vertical curve.

Layout: accesses the Parabolic Curve Layout screen (Page R-188) where you can solve for an elevation at a specified station, or solve for a station at a specified elevation.

Results

PVC sta.: is the station at the PVC.

PVI sta.: is the station at the PVI.

PVT sta.: is the station at the PVT.

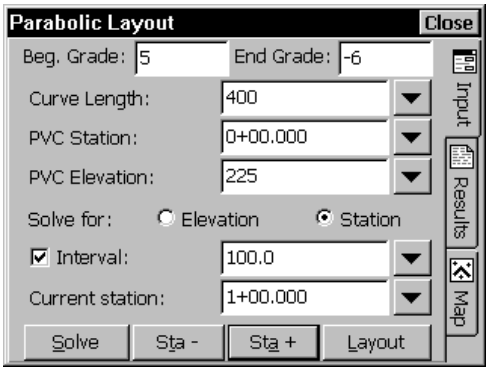
Hi/Lo sta.: is the station where the vertical curve has a tangent equal to zero (the crest of the curve).

elev.: is the elevation for the respective point.

Parabolic Layout

7 Curve | I Parabolic Layout

The Parabolic Layout screen allows you to compute an elevation at a specified station, or a station at a specified elevation.



Beg. Grade: is the percent grade at the PVC.

End Grade: is the percent grade at the PVT.

Curve Length: is the horizontal distance between the PVC and PVT.

PVC Station: is the starting station at the PVC.

PVC Elevation: is the elevation at the PVC.

Solve for: is where you select to solve for an unknown Elevation, or an unknown Station. The selection made here determines which of the following choices will be available.

☑ **Interval**: when checked, the Current station can be incremented by the specified interval by using the Sta - and Sta + buttons and then re-computed with the Layout button.

Current station: is the station that will be solved for with the Layout button.

Elevation: is the known elevation for the location(s) on the parabolic curve where you want to compute the station(s).

Solve: computes the details of the vertical curve.

Sta -: decreases the Current station by the Interval.

Sta +: increases the Current station by the Interval.

Layout: computes either the elevation at the specified Current station or the station(s) at the specified Elevation.

Results

PVC sta.: is the station at the PVC.

PVI sta.: is the station at the PVI.

PVT sta.: is the station at the PVT.

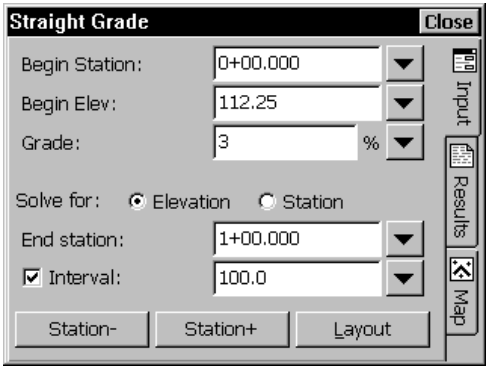
elev.: is the elevation for the respective point.

Hi/Lo sta.: is the station where the vertical curve has a tangent equal to zero (the crest of the curve).

Straight Grade

7 Curve | J Straight Grade

The Straight Grade screen will solve for the elevation at a specified station or a station at a specified elevation on a straight grade.



Begin Station: is the station where the straight grade begins.

Begin Elev: is the elevation at the Begin station.

Grade: is the percent slope ($\frac{\text{Rise}}{\text{Run}} \cdot 100$).

Solve for: is where you select to solve for an Elevation or a Station. The choice made here determines which of the following selections are available.

End station: is the station where you want to compute the elevation.

☑ **Interval**: when checked, the End station can be incremented by the specified interval by using the Station- and Station+ buttons and then re-computed with the Layout button.

End Elevation: is the elevation at the point where you want to compute the station.

Layout: performs the computation and displays the results.

Results

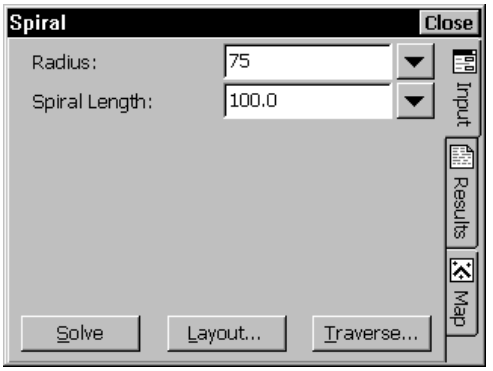
Station: is the current station.

Elevation: is the elevation for the current station.

Spiral

7 Curve | K Spiral

The Spiral screen will compute the details of a spiral curve, given the spiral length and radius.



Spiral length: is the length of the spiral curve.

Radius: is the circular curve radius.

Solve: computes the details of the spiral curve.

Layout...: accesses the Spiral Layout screen (Page R-192) where the location of stations on the spiral curve can be computed.

Traverse...: accesses the Traverse on Spiral screen (Page R-193).

Results

X of Throw: is the distance along the tangent where a perpendicular line intersects with the radius point.

Y of Throw: is the minimum distance between the tangent and the extended circular curve.

X: is the distance from the TS to the SC along the tangent.

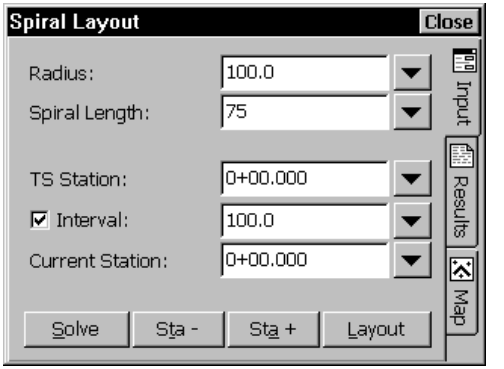
Y: is distance from the SC to the tangent.

Delta: is the angle between the tangent, and the line between the PI and SC.

Spiral Layout

7 Curve | L Spiral

The Spiral Layout screen is used to compute station locations on a spiral curve.



Radius: is the radius of the circular curve.

Spiral Length: is the length along the spiral curve from TS to SC.

TS station: is the station at the TS point.

☑ **Interval**: when checked, is the spiral arc distance that is added or subtracted from the Current Station using the Sta + and Sta – buttons.

Current Station: is the station on the curve that is computed.

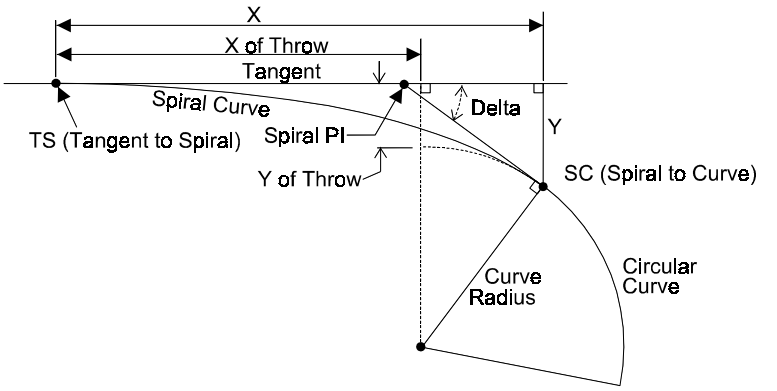
Solve: solves and displays the details for the specified spiral curve.

Sta -: decreases the Current Station by the specified Interval.

Sta +: increases the Current Station by the specified Interval.

Layout: computes the location of the Current Station.

Results



Station: is the current station.

Deflection: is the horizontal angle to the current station as if occupying the TS and backsighting the Spiral PI.

Long crd.: is the chord

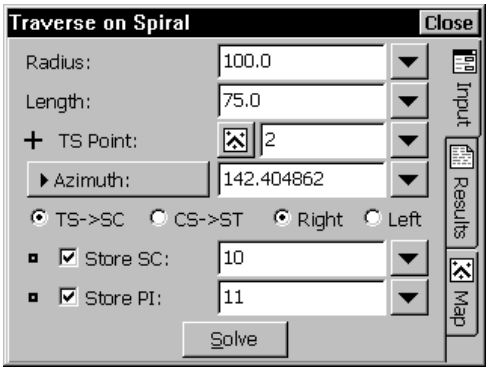
length from the TS to the current station.

Short crd.: is the chord length from the previous station to the current station.

Traverse on Spiral

7 Curve | M Spiral

The Traverse on Spiral screen is used to compute the location of, and optionally store the SC, or ST and spiral PI points.



Radius: is the radius of the circular curve.

Length: is the length along the spiral curve from TS to SC.

TS / **CS Point**: is the existing point associated with the TS or CS point.

Azimuth / Bearing: is the tangent direction at the TS or CS point.

TS->SC: specifies that the curve starts at the tangent to spiral and ends at the spiral to curve.

CS->ST: specifies that the curve starts at the curve to spiral and ends at the spiral to tangent.

Right / **Left**: specifies is the curve turns toward the right or left as you face the spiral from the TS or CS.

☑ **Store SC** / **ST**: when checked, saves a point for the computed SC point.

☑ **Store PI**: when checked, saves a point for the computed spiral PI.

Results

Tangent In: the tangent direction entering the spiral at the TS or CS.

Tangent Out: the tangent direction exiting the spiral at the SC or ST.

X of Throw: is the distance along the tangent where a perpendicular line intersects with the radius point.

Y of Throw: is the minimum distance between the tangent and the extended circular curve.

X: is the distance from the TS to the SC along the tangent.

Y: is distance from the SC to the tangent.

Delta: is the angle between the tangent, and the line between the PI and SC.

Roads Menu

The Roads Menu contains the routines used to perform road layout.

A: Edit Templates

B: Edit Alignments

C: Edit Roads

D: Road Stakeout

E: Slope Staking

F: Show Station (Road Station and Offset)

Add/Edit Templates

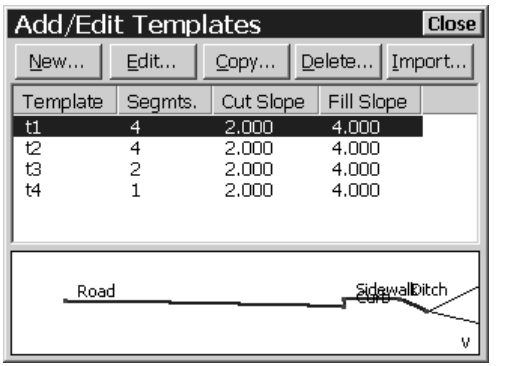
8 Roads | A Edit Templates

The Add/Edit Templates screen is used to edit an existing template or create a new template.

Templates describe the cross-sectional profile of a roadway. They can contain information such as the road width, its slope, a curb, and/or a ditch. Each separate portion of a template is called a *segment*. All templates must have at least one segment and all templates of a particular road must have the same number of segments.

Any template can describe either the left or right side of the road's cross-section (they're reversible). If a road's left and right side are identical, only one template needs to be created; the other side can use the same template, or be "mirrored" later when the road is defined.

All of the saved templates are listed displayed in this screen including each template's name, number of segment, cut slope, and fill slope. An image of the selected segment is also displayed in this screen.



New...: opens the New Template screen where a new template can be created. This screen is identical to the Edit Template screen except most the buttons are initially deactivated.

Edit...: opens the Edit Template screen where the selected template can be edited.

Copy...: opens the Save As dialog box where a copy of the selected template can be saved with a different name.

Delete...: deletes the selected template.

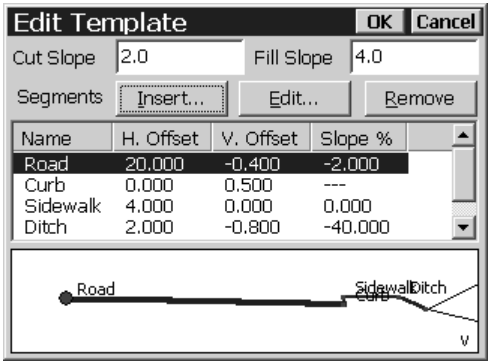
Import...: opens the Open dialog box where a template can be copied from one folder to the current folder and imported into the job.

Edit Template

8 Roads | A Edit Templates | Edit... or

8 Roads | A Edit Templates | New...

The Edit Template screen is identical to the New Template screen and is used to create a new template or edit an existing one.



All of the segments of the current template are listed in the screen. The list shows the name of each segment, the horizontal and vertical offsets (lengths), and the slope.

Note: The length of the first segment must be greater than zero.

Cut Slope: is the slope that will be used when locating the catch point in a situation where the existing terrain is above the level of the hinge point.

Fill Slope: is the slope that will be used when locating the catch point in a situation where the existing terrain is below the level of the hinge point.

Insert...: opens the Edit Segment screen where a new segment will be added prior to (above) the segment selected in the Edit Template screen.

Note: To add a segment to the end of all existing segments (furthest away from the centerline), be sure <End> is selected from the Edit Template screen prior to tapping Insert....

Edit...: opens the Edit Segment screen where the details of the selected segment can be edited.

Note: The selected segment is shown with a thicker line in the map view in the lower portion of the Edit Template screen.

Remove: removes the selected segment and automatically joins the previous segments to the following segments.

Note: When a segment is removed the existing segments toward the centerline will not change. Only those on the side of the removed segment away from the centerline are adjusted.

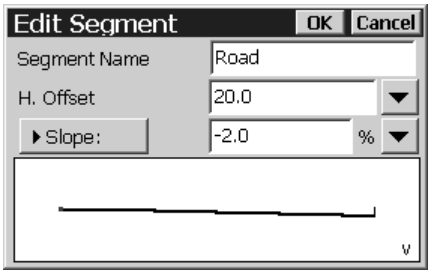
Edit Segment

8 Roads | A Edit Templates | Edit... | Insert... or

8 Roads | A Edit Templates | Edit... | Edit... or

8 Roads | A Edit Templates | New... | Insert...

The Edit Segment screen is identical to the New Template screen and is used to create a new template or edit an existing one.



Segment Name: is the name for the segment. A name is required, but it does not have to be unique.

H. Offset: is the horizontal length of the offset

Slope / V Offset: is the slope of the segment, or the vertical length, respectively. When defining a vertical offset, select the ⊙D if the segment travels downward, or select ⊙U if the segment travels upward from the point of view of the centerline.

Note: A segment with a negative slope will result in water that flows from the centerline toward the road edge.

Edit Alignments

8 Roads | B Edit Alignments or

1 Job | F Edit Alignments

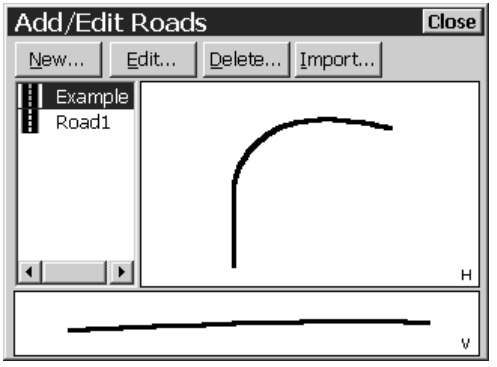
The Edit Alignments screen is used to create an alignment that defines the centerline of a road containing both horizontal and vertical elements. Editing alignments is fully described, starting on Page R-48.

Add/Edit Roads

8 Roads | C Edit Roads

The Add/Edit Roads screen is used to define your road. This is where the templates are added to the alignment and any widenings and super elevations are defined.

All existing roads are listed in this screen. If an existing road is selected, the overhead and profile view of that road are also displayed.



New...: Opens the New Road screen where a new road can be defined.

Edit...: Opens the Edit Road screen where the selected road can be edited. The Edit Road screen is identical to the New Road screen.

Delete...: Opens the following prompts to delete the selected road(s).

- **Are you sure you want to delete the selected Roads?**: Answering **Yes** to this prompt will disassociate the selected road(s) from the current job so they are no longer displayed in the Add/Edit Roads screen. In this case, the road can still be re-associated with the Import... routine.

Answering **No** to this prompt will return you to the Add/Edit Roads screen without making any changes.

- **Delete alignment *alignment name*?**: Answering **Yes** to this prompt will delete the selected alignment(s) from the current job so they are no longer displayed in the Edit Alignments screen. In this case, the alignment can be re-associated with the Import... routine from the definition in the RD5 file. Answering **No** to this prompt will open the next prompt without deleting the selected alignment(s) from the current job.
- **Delete *Roadname*.RD5 file?**: Answering **Yes** to this prompt will permanently delete the selected alignments and road (RD5) files from the data collector.

Import...: Opens the Import Road screen where an existing road (RD5) file can be added to the current job. This is useful to copy road files that were transferred to the data collector from a PC and to add roads that were stored in a directory other than the current directory.

New Road Screen / Edit Road

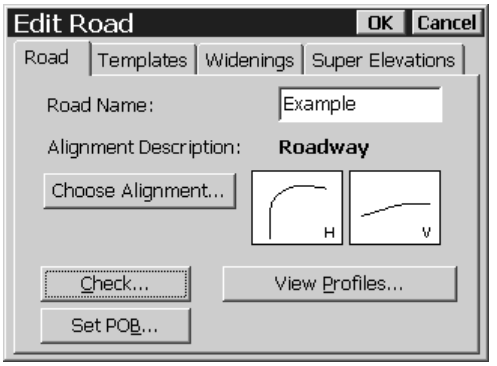
8 Roads | C Edit Roads | New... or Edit...

The New Road screen is identical to the Edit Road screen and is used to assemble the parts of a road or edit an existing road. This screen consists of five separate index card style tabs. Each tab accesses a different card that is used to define a particular part of the road.

The Road Card

8 Roads | C Edit Roads | (New... or Edit...) | Road

The Road card of the New Road screen is used to select the alignment to use for the road. If an alignment has not yet been created, refer to Page R-48 for information on creating an alignment.



Road Name: is the name assigned to the road. The name must not be the same as any existing road name.

Alignment Description: displays the name of the selected alignment.

Choose Alignment: opens the Choose Alignment screen where an existing alignment can be selected.

Check: checks the road for errors and displays the results in the Roads Report screen.

View Profiles: opens the Road Profiles screen where you can see information about the cross-sectional profile of the road at any station.

Set POB...: opens the Road Alignment Properties screen where information about the current alignment can be changed.

Roads Report Screen

8 Roads | C Edit Roads | (New... or Edit...) | Road | Check...

The Roads Report screen displays a list of any errors after performing the following tests.

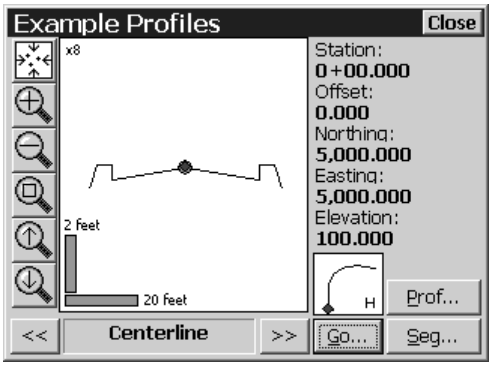
- Confirm that the alignment contains both a HAL and a VAL.
- Confirm that the horizontal length of the VAL is greater than or equal to the HAL.
- Confirm there is at least one template for each side of the road.

- Confirm the first template coincides with the starting station.
- Confirm that all template segments have a name. (The names do not have to be unique.)
- Confirm that the same number of segments exist on each side of the alignment.
- Confirm that each widening start station is less than the corresponding widening's end station.
- Confirm that one widening does not overlap with another widening.
- Confirm that the start station for each super elevation is less than the end station.
- Confirm that no two super elevations overlap.
- Confirm that the start and end of each super elevation either both hinge on the centerline or both hinge on the edge.
- Confirms all templates, widening and super elevations are on the alignment.
- Confirms no more than one template exists at any particular station on the same side of the road.
- Confirms the first segment of all templates is greater than 0.
- Checks for empty templates.
- Checks for widenings with zero width.
- Checks for overlapping parabolic transitions.
- Checks for template-widening width matching.
- Checks for template-super elevation slope matching.

Road Profiles Screen

8 Roads | C Edit Roads | (New... or Edit...) | Road | View Profiles...

The Road Profiles screen allows you to see information about the cross-sectional profile of the road at any station after at least one template has been added to each side of the road.



<<, >>: these buttons move a circle icon that starts at the centerline to each node of the template at the current station. Information for the selected segment is displayed in the right portion of the screen. The name for the selected segment is shown between these buttons.

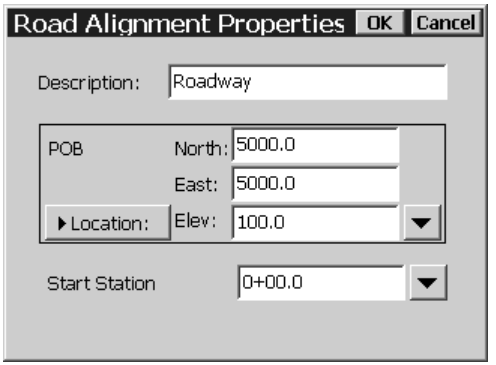
Go...: opens a dialog box where a specific station can be entered. Once OK is tapped, the profile at the entered location is shown in the Road Profiles screen.

Prof...: opens the Details screen and lists several details about the road's cross-sectional profile at the current station.

Seg...: opens the Details screen and lists information related to the selected segment at the current station.

Road Alignment Properties Screen

8 Roads | C Edit Roads | (New... or Edit...) | Road | Set POB...



The Road Alignment Properties screen is used to change information about the current alignment.

Description: is the name of the current alignment. A new name can be assigned to the alignment from this field.

Point / Location: depending how this button is toggled, you can change the POB of the alignment by entering a new point number or new coordinates.

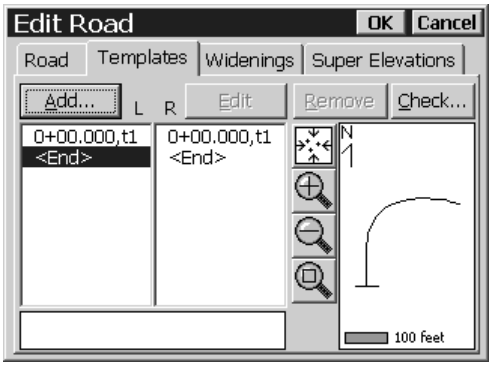
Start Station: replaces the existing starting station of the alignment with the starting station entered here.

The Templates Card

8 Roads | C Edit Roads | (New... or Edit...) | Templates

The Templates card of the New Road screen is used to add existing templates to the road.

The screen displays a list of left and right templates that are currently assigned to the road. When a particular template is selected, a cross-sectional profile view of the selected template is displayed and an overhead view shows where the selected template occurs on the alignment.



Add...: when a template or <End> is selected from the L or R columns in the Templates card, this button opens the Add Template screen, which allows you to add a new template to the same side of the road that was selected.

Edit: allows you to edit the selected template in the Edit Template screen, which is identical to the Add Template screen.

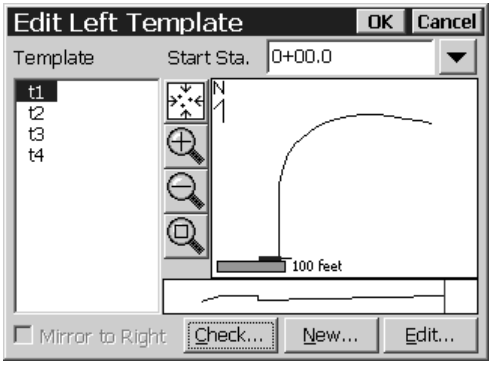
Remove: removes the selected template from the list.

Check...: checks the road for errors and displays the results in the Roads Report screen, described above.

Add / Edit Template Screen

8 Roads | C Edit Roads (New... or Edit...) | Templates (Add... or Edit...)

The Add / Edit Template screen allows you to add a template to the road or edit an existing template.



Template: The Template column lists all the templates that can be added to the road. Selecting a template will display an image of that template in the lower corner of the screen. Once the first template is added, this box will only list templates with the same number of segments as the first.

Start Sta: is the location of the template on the alignment.

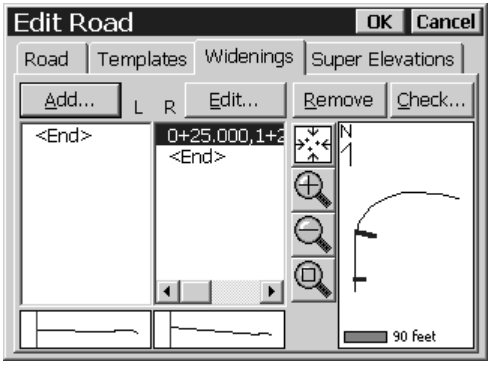
Check...: opens the Roads Report screen and displays any errors (see Page R-201)

New...: opens the New Template screen, which is identical to the Edit Template screen, where a new template can be created (see Page R-197).

Edit...: opens the Edit Template screen where the selected template can be modified (see Page R-197), although accessing the templates editor from here will not allow inserting or removing of segments.

The Widenings Card

8 Roads | C Edit Roads (New... or Edit...) | Widenings



The Widenings card of the New Road screen is used to add or edit widenings.

A widening is a section of a road that changes in width, but does not necessarily require any new templates. The road width is adjusted by changing only the width of the first segment of the template that leads into the beginning of the widening. Any additional segments, like those that may describe a sidewalk or ditch, are not adjusted.

The following rules must be considered when adding a widening to a road:

- A widening must have a starting station and an ending station or a length.
- Left and right widenings are separate and independent of each other.
- The start and end stations must occur within the boundaries of the alignment.
- The starting station must occur before the ending station.
- The beginning of a widening must match the width of the previous widening or template.
- The end of a widening must match the next template or widening unless it is the last element in the road.
- The beginning or ending of a widening cannot occur within the boundaries of another widening, but the beginning of one widening can occur at the same station as the end of a previous widening.
- Widenings are always positioned by their start station.

Add... : when a widening or <End> is selected from the L or R columns in the Widenings card, this button opens the Add Widening screen, which allows you to add a widening to the same side of the road that was selected.

Edit : allows you to edit the selected widening in the Edit Widening screen, which is identical to the Add Widening screen.

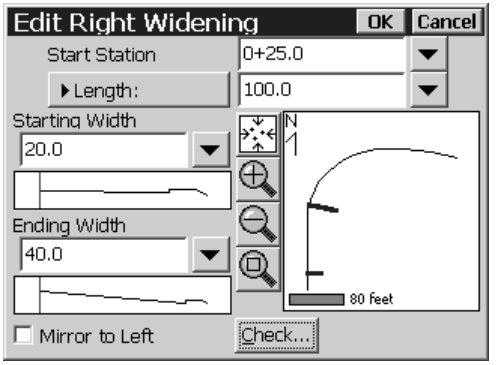
Remove : removes the selected widening from the list.

Check... : checks the road for errors and displays the results in the Roads Report screen, described on Page R-201.

Add / Edit Widening Screen

8 Roads | C Edit Roads (New... or Edit...) | Widenings (Add... or Edit...)

The Add / Edit Widening screen allows you to add a widening to the road or edit an existing widening.



Start Station: is the location of the beginning of the widening on the alignment.

Length / End Station: is the length of the widening measured from the Start Station, or it is the end station, depending on how the button is toggled.

Starting Width: is the starting width of the widening. This must match the width of the previous template, or widening.

Ending Width: is the ending width of the widening.

Check...: opens the Roads Report screen and displays any errors (see Page R-201)

New...: opens the New Widening screen, which is identical to the Edit Widening screen, where a new widening can be created (see Page R-197).

Edit...: opens the Edit Widening screen where the selected widening can be modified (see Page R-197).

☑ **Mirror to Right** / **Left**: duplicates the widening to the other side of the road when checked.

Super Elevations Card

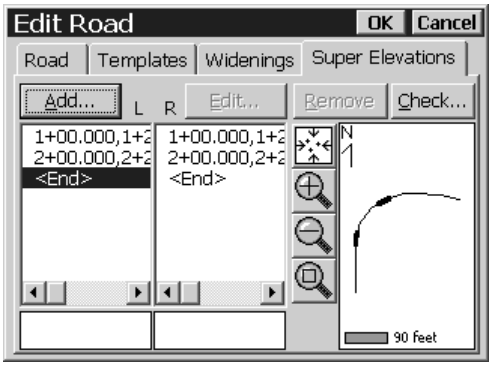
8 Roads | C Edit Roads (New... or Edit...) | Super Elevations

The Super Elevations card of the New Road screen is used to add or edit super elevations.

A super elevation changes the cross slope of the first segment of a template in order to bank a curve – the slope of any remaining segments will remain unadjusted. One super elevation defines a begin point and an end point where the slope change begins and

where it finishes the transition for one side of a road. Therefore, to bank a two-lane road, four super elevations would be required – one at the beginning and one at the end of the curve for each side of the road.

A super elevation can either hinge at the outer edge of the first segment, or at the centerline. Hinging at the center results in the elevation of the outer segments to change. Hinging at the edge results in the elevation of the centerline changing. Because of this, Survey Pro will only allow you to hinge on edge for one side of a road. If the other side is also super elevated, you will be forced to hinge that side at the center so that an abrupt change in elevation does not occur at the centerline.



Add... : when a super elevation or <End> is selected from the L or R columns in the Super Elevations card, this button opens the Add Super Elevation screen, which allows you to add a super elevation to the same side of the road that was selected. (Widenings and super elevations are always sorted in this list by their specified start stations.)

Edit : allows you to edit the selected super elevation in the Edit Super Elevation screen, which is identical to the Add Super Elevation screen.

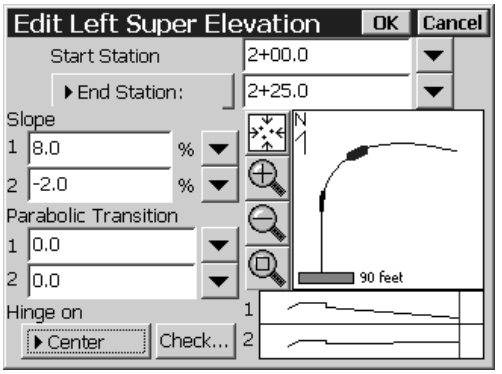
Remove : removes the selected super elevation from the list.

Check... : checks the road for errors and displays the results in the Roads Report screen, described on Page R-201.

Add / Edit Super Elevation Screen

8 Roads | C Edit Roads (New... or Edit...) | Super Elevations (Add... or Edit...)

The Add / Edit Super Elevation screen allows you to add a super elevation to the road or edit an existing super elevation.



Start Station: is the location of the beginning of the super elevation on the alignment.

Length / End Station: is the length of the super elevation measured from the Start Station, or it is the end station, depending on how the button is toggled.

Note: Keep in mind that the slope at the end of a super elevation will continue down the road unless another super elevation is entered to change the slope back again. For example, a curve will typically require two super elevations for each side of the road: one at the beginning of the curve and one at the end.

Slope 1 / **2**: is the starting and ending slopes of the road, respectively. The starting slope must match the current slope of the road at that station.

Parabolic Transition 1 / **2**: is the length of the vertical curve that will lead in and out of the super elevation, respectively. Parabolic transitions are optional parts of a super elevation and result in a smoother change going into and coming out of a super elevation, similar to how a spiral curve is used with a horizontal curve.

Note: One half of the parabolic transition length will extend before and after the starting point and/or the ending point of the super elevation. This should be considered when using parabolic transitions near the end of an alignment since this length cannot extend beyond the limits of the road.

Hinge on ▸ Center / ▸ Edge: determines if the super elevation is computed by rotating the road around the centerline or the road's edge.

Note: When hinging on edge, the road is actually rotated around the end of the first segment of the template that leads into the super elevation.

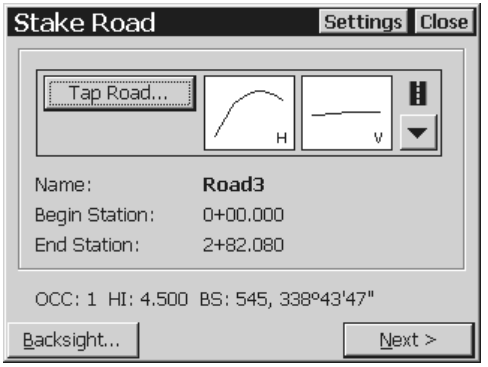
Only the first segment is adjusted with a super elevation. The length and slope of any segments beyond the first will not be adjusted from a super elevation.

Check...: checks the road for errors and displays the results in the Roads Report screen, described on Page R-201.

Road Stakeout

8 Roads | D Road Stakeout

The Stake Road screen is used to stake any segment of a road profile at any station.



Tap Road...: opens the Tap on a Road screen where you can tap on any road in the job to select it.

Name: displays the name of the selected road.

Begin Station: displays the station assigned to the beginning of the road.

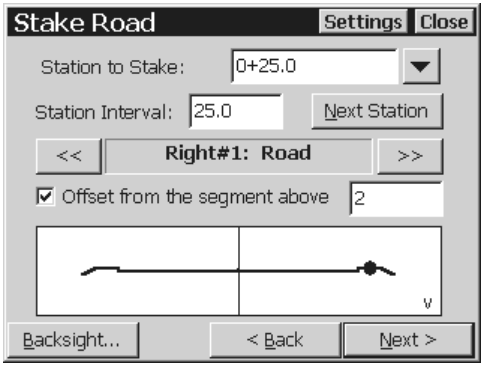
End Station: displays the final station in the road.

Backsight...: accesses the Backsight Setup screen (Page R-72).

Next >: takes you to the next Stake Road screen where a specific point on the road can be selected to stake.

Stake Road – Screen Two

The second Stake Road screen displays a cross-sectional profile view of the road at the current station. Any particular point on this view can be selected and staked.



Station Interval: is the value that is added to the Station to Stake after the Next Station button is pressed.

Next Station: advances the Station to Stake by the Station Interval.

Note: If the Stake Corners option is selected in the Stakeout Settings screen, the Next Station button will also stop at any horizontal or vertical alignment node, and the beginning and end of any widening and super elevation that falls within the interval.

<< , >>: These buttons are used to select the particular node, or an offset to it, from your road profile that you wish to stake. The segment name at the selected node is also displayed. If staking the centerline with an offset, the side of the road that the offset occurs is also displayed.

Offset: when checked, allows you to specify an offset distance to stake as opposed to staking the actual node locations.

Note: A **positive** value offset is applied at the specified distance from each node **away from the centerline**. A **negative** value offset is applied at the specified distance from each node **toward the centerline**.

Note: If an offset occurs past the edge of the road, no vertical or cut / fill information will be computed for that point.

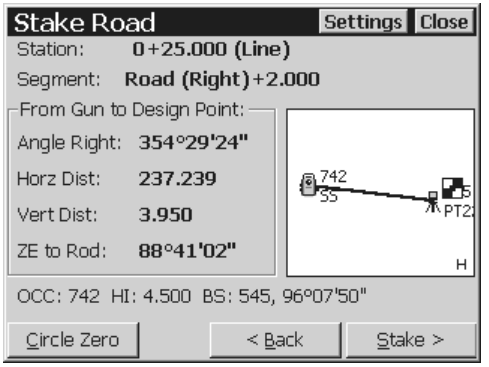
Backsight...: accesses the Backsight Setup screen (Page R-72).

< Back: returns to the previous screen.

Next >: takes you to the next Stake Road screen where the direction and distance information to the stake point is displayed.

Stake Road – Screen Three

The third Stake Road screen displays distance, direction, and other information about the point to be staked.



Station: displays the station where the stake point occurs and the type of line segment it falls on in the alignment.

Segment: displays the name of the segment tangent to the point to be staked; if the point is on the Left or Right side of the road; and the specified offset, if any.

Angle Right: is the horizontal angle from the backsight to the stake point.

Horz Dist: is the horizontal distance from the total station to the stake point.

Vert Dist: is the vertical distance from the total station to the stake point.

ZE to Rod: is the zenith angle from the total station to the stake point.

Circle Zero: is used to modify the circle on the total station so that the angle right reading will be zero when it is facing toward the design point, which can sometimes be easier than turning to an obscure angle value. When this button is tapped, the following actions will occur:

1. A new backsight circle value is computed, sent to the instrument and stored in the raw data
2. The Angle Right value is changed to zero to reflect the change. The instrument now needs to be turned horizontally to zero to face the design point.
3. To prevent errors, the backsight set up is invalidated when exiting the Stakeout dialog if this button has been used. A Circle zeroed on a design point is meaningless once the design point has been staked.

< Back: returns to the previous screen.

Stake >: accesses the final Stake Road screen where the shots to the stake point are performed.

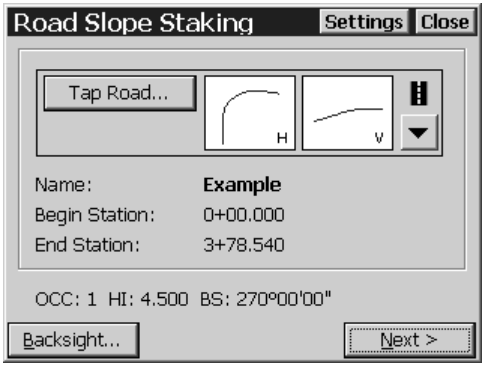
Stake Road – Screen Four

The fourth and final Stake Road screen is used to perform the shots necessary to locate the design point. This screen is identical to the final Stake Points screen, which is explained on Page R-105.

Road Slope Staking

8 Roads | E Slope Staking

The Road Slope Staking screen is used to locate the catch point of the road at any station.



Tap Road...: opens the Tap on a Road screen where you can tap on any road in the job to select it.

Name: displays the name of the selected road.

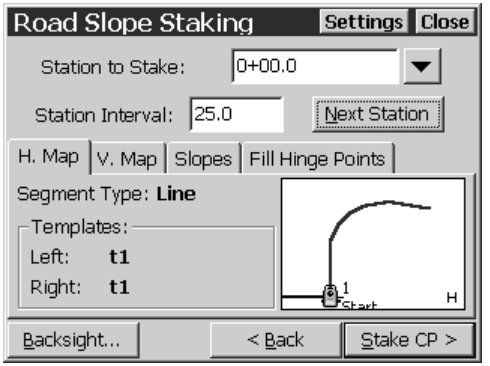
Begin Station: displays the station assigned to the beginning of the road.

End Station: displays the final station in the road.

Backsight...: accesses the Backsight Setup screen (Page R-72).

Next >: takes you to the next Road Slope Staking screen where the slope staking parameters are set up.

Road Slope Staking – Screen Two



The second Road Slope Staking screen is used to set up some slope stake parameters prior to slope staking the road.

Station to Stake: is the station to be slope staked.

Station Interval: specifies how far to advance from the current station to the next station.

Next Station: advances the current station by the Station Interval.

Note: If the Stake Corners option is selected in the Stakeout Settings screen, the Next Station button will also stop at any horizontal or vertical alignment node, and the beginning and end of any widening and super elevation that falls within the interval.

Backsight...: accesses the Backsight Setup screen (Page R-72).

< Back: returns to the previous screen.

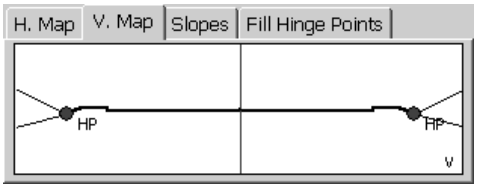
H. Map Card

The H. Map card displays information about the horizontal details of the road at the current station.

Segment Type: displays the type of horizontal section at the current station.

Left / **Right**: is the description of the left and right templates that are being used at the current station.

V. Map Card



The V. Map card displays a graphic of the cross-sectional profile of the road at the current station. The hinge points and slopes are also displayed.

Slopes Card

The Slopes card is used to specify the desired cut and fill slopes that will be used when computing the location of the catch points. These values are always initialized from the templates every time the station to be staked is modified. You can then override these default values here to account for terrain constraints. Changes to slopes will be adequately reflected in the V. Map card graphic.

Cut Slope: is the left and right slope, respectively, to use when the terrain requires a cut (the hinge point is located below the terrain's surface).

Fill Slope: is the left and right slope, respectively, to use when the terrain requires a fill (the hinge point is located above the terrain's surface).

Fill Hinge Points Card

When the terrain requires a fill, you have the option to compute the hinge point at any existing template segment. The option to use a segment other than the last segment can simplify the situation where a ditch meets an area requiring a fill, which would otherwise result in an area with two similar or identical negative slopes.

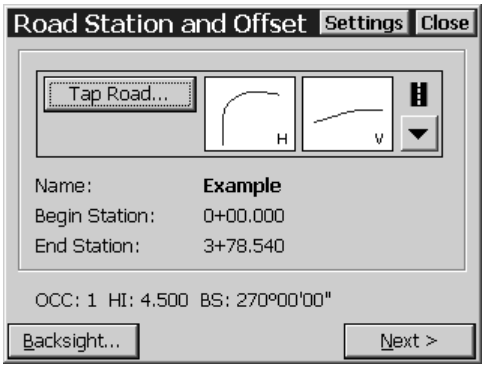
Left / **Right**: is the specified left and right segment, respectively, to compute the hinge point from in a situation that requires a fill. Changes to these fields will be reflected in the V. Map card graphic.

Stake CP >: opens the next slope staking screen. The following slope staking screens are identical to non-road layout slope staking screens and are described starting on Page R-119.

Road Station and Offset

8 Roads | F Show Station

The Road Station and Offset routine allows you to take a shot to a prism that is positioned anywhere on the road and compute the details of where that point is located in relation to the road. This information can then be compared to the data from a grade sheet.



Tap Road...: opens the Tap on a Road screen where you can tap on any road in the job to select it.

Name: displays the name of the selected road.

Begin Station: displays the station assigned to the beginning of the road.

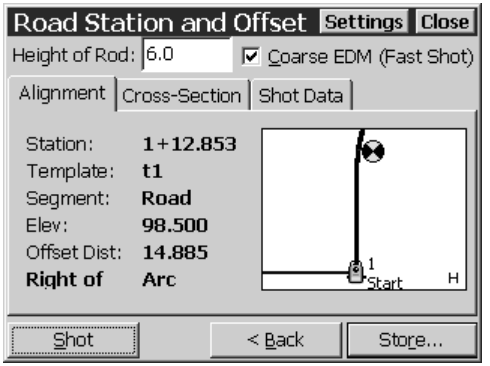
End Station: displays the final station in the road.

Backsight...: accesses the Backsight Setup screen (Page R-72).

Next >: takes you to the next Road Station and Offset screen where the slope staking parameters are set up.

Road Station and Offset – Screen Two

The second Road Station and Offset screen is used to take a shot to the prism and view the data from various cards.



Height of Rod: is the length of the rod.

☑ **Coarse EDM (Fast Shot)**: when checked, sets the total station to coarse mode for faster, but slightly less-precise measurements.

Shot: takes a shot to the prism.

< Back: returns to the previous screen.

Store...: stores the stake point.

Alignment Card

Station: displays the station at the rod position.

Template: displays the name of the template that is used at the rod position.

Segment: displays the name of the template's segment at the rod position.

Elev: displays the elevation at the rod position.

Offset Dist: displays the perpendicular offset from the centerline to the rod position.

Right of Line / **Left of Line** / **On Line**: displays if the rod position is to the right of the centerline, left of the centerline, or on the centerline, respectively.

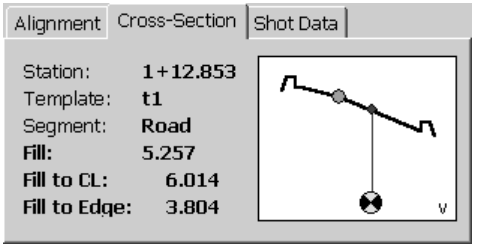
Cross-Section Card

Station: displays the station at the rod position.

Template: displays the name of the template that is used at the rod position.

Segment: displays the name of the template's segment at the rod position.

Cut / **Fill**: is the necessary cut or fill that will bring the rod position even with the road's surface.

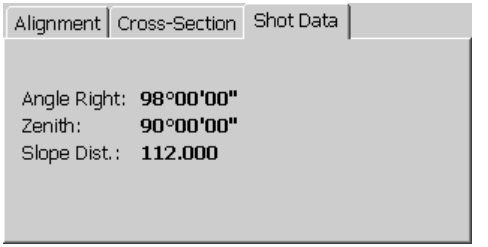


Cut / **Fill to CL**: is the necessary cut or fill that will bring the rod position to the same elevation as the centerline at the current station.

Cut / **Fill to Edge**: is the necessary cut or fill that will bring the rod position to the same elevation as the outer edge of the last segment at the current station.

Shot Data Card

Displays the angles and distance measured by the total station from the last shot.



Adjust Menu

The Adjust Menu contains routines to perform a variety of adjustments.

A: Scale

B: Translate

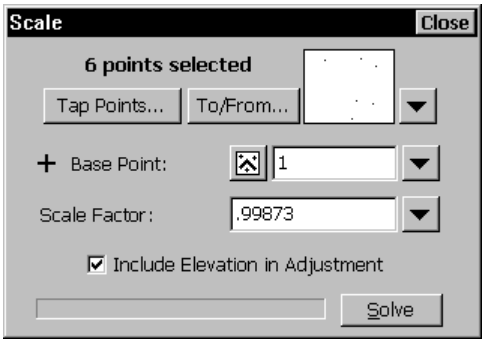
C: Rotate

D: Traverse Adjust

Scale

9 Adjust | A Scale

The Scale screen will scale the distances of a range of points relative to a specified base point. This is useful to correct a survey where a scale factor was inadvertently applied during data collection.



Tap Points...: allows you to select points by tapping them from a map view.

To/From...: allows you to select points by typing in a point range.

Base point: The distances to all the selected points will be scaled relative to this point. (The coordinates for the base point will not change.)

Scale factor: is the scale factor that is applied to the distances from the base point to the selected points.

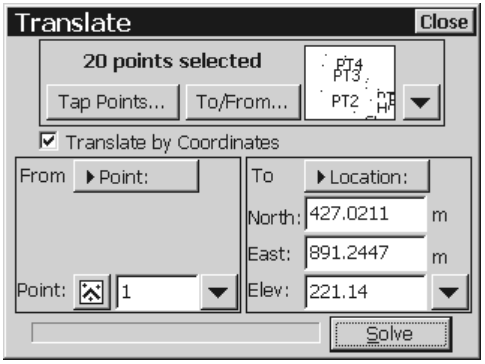
☑ **Include Elevation in Adjustment**: when checked, the elevations to the selected points will also be adjusted by the scale factor relative to the Base point.

Solve: will perform the adjustment on the selected points and change the coordinates accordingly.

Translate

9 Adjust | B Translate

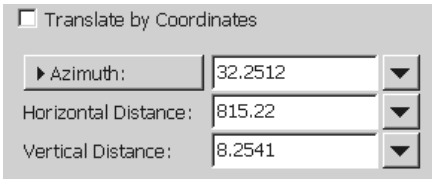
The Translate screen will move a group a points horizontally and vertically by a specified distance and direction.



Tap Points...: allows you to select points by tapping them from a map view.

To/From...: allows you to select points by typing in a point range.

☑ **Translate by Coordinates**: when checked, all of the selected points will be adjusted in the same direction and distance as between a specified From point or location and a To point or location. When unchecked, the selected points will be adjusted by the specified direction and distance. The choice made here determines the options available below.



Note: The choice made above determines which fields will be available below.

Azimuth / Bearing: is the direction to move the selected points.

Horizontal Distance: is the horizontal distance that the selected points are moved.

Vertical Distance: is the vertical distance that the selected points are moved.

From: is where the first point or location is defined that is used to compute the direction and distance that the selected points are adjusted.

To: is where the last point or location is defined that is used to compute the direction and distance that the selected points are adjusted.

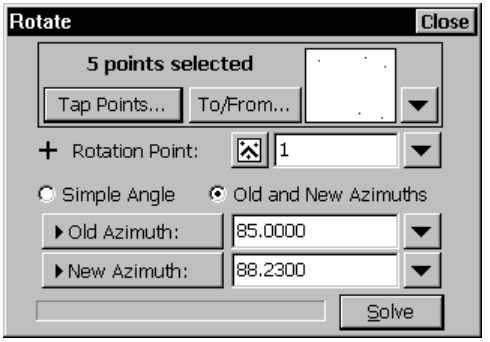
▸ Point / ▸ Location: allows you to enter either a point name or location coordinates.

Solve: adjusts the selected points in the same direction or distance as defined from the From point to the To point, or by the direction and distance entered.

Rotate

9 Adjust | C Rotate

The Rotate screen will rotate selected points around a specified point. This is useful to correct a survey where an incorrect backsight was used during data collection.



Tap Points...: allows you to select points by tapping them from a map view.

To/From...: allows you to select points by typing in a point range.

Rotation Point: The selected points will be rotated around the point specified here. (The coordinates for the rotation point will not change.)

Simple Angle: when selected, this allows you to enter the deflection angle to rotate the selected points.

Old and New Azimuths: when selected, this allows you to enter an old and new azimuth, which is used to compute the angle to rotate the selected points.

Note: The choice made from the two options above determines which fields will be available below.

Rotate: is the angle to rotate the selected points around the Rotation point.

▸ Old Azimuth / ▸ Old Bearing: is a known direction between any two points in the current job before they are rotated.

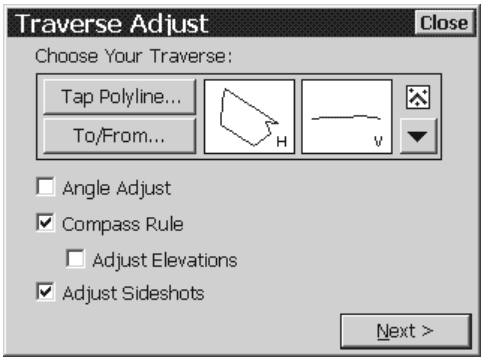
▸ New Azimuth / ▸ New Bearing: is the direction between the same two points specified above after the rotation.

Solve: will perform the rotation on the selected points and change the coordinates accordingly.

Traverse Adjust

9 Adjust | D Traverse Adjust

The Traverse Adjust wizard is a series of screens that allow you to adjust a closed traverse for angular error and/or perform a compass rule adjustment on a closed or open traverse.



Choose Your Traverse: is used to select a traverse to adjust from the following options:

- Tap Polyline...: is used to tap an existing polyline from a map view.
- To/From...: provides selection of points by point name.

☑ **Angle Adjust**: when checked, will perform an angle adjustment to the closed traverse. An angle adjustment will apply the angular error equally among all of the angles of the closed traverse and adjust the coordinates for all but the first two traverse points. (The first leg of the traverse is not adjusted.)

☑ **Compass Rule**: when checked, will perform a compass rule adjustment on the selected traverse.

☑ **Adjust elevation**: when selected, the elevations for the traverse points are also adjusted from the compass rule adjustment.

☑ **Adjust Sideshots**: when checked, any side shots that were stored while occupying the traverse points in the selected traverse will also be adjusted.

The side shot locations will be recomputed using the original angles and distances stored in the raw data file along with the adjusted locations of the occupy and backsight points.

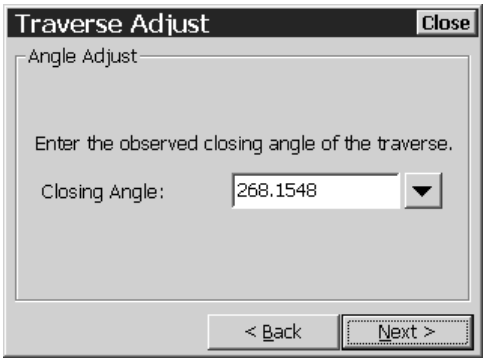
The user cannot explicitly define the side shots that are adjusted. Instead, they are determined by the information stored in the raw data file. If no side shots were stored from any of the traverse points, an error message will be displayed and no adjustment is performed.

If any of the following settings were changed during or after the traverse was recorded, then side shots cannot be adjusted.

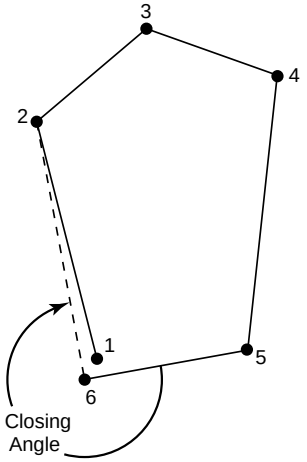
- Distance units
- Angle units
- Earth curvature adjustment
- Scale factor

Next > : opens the next screen of the adjustment wizard.

Traverse Adjust – Angle Adjustment



If an angle adjustment is being performed, this screen will appear next.

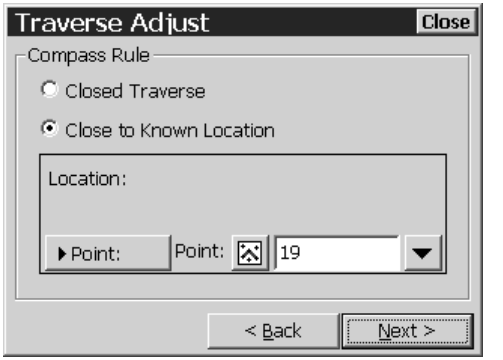


Closing Angle: is the closing angle for the traverse, which must be represented as an angle-right. (See illustration.)

Next > : opens the next screen of the adjustment wizard.

Traverse Adjust – Compass Rule

If a compass rule adjustment is being performed, this screen will appear next.



Closed Traverse: select this option if you are adjusting a closed traverse.

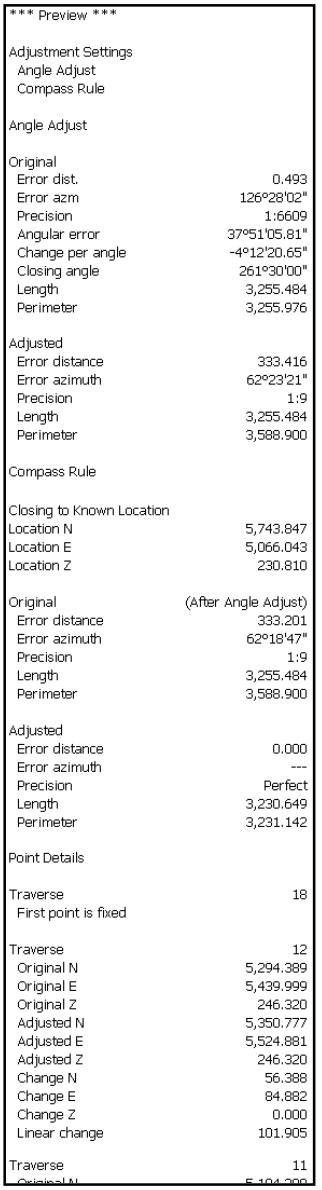
Close to Known Location: select this option if you are adjusting an open traverse and closing to a known point or location.

Note: if a closing location is not specified, it is automatically assumed that the first point of the traverse will be the closing location.

- ▸ Location: allows you to enter coordinates to define the closing location.
  - **North**: is the Y-coordinate for the closing location.
  - **East**: is the X-coordinate for the closing location.
  - **Elev**: is the elevation for the closing location.
- ▸ Point: allows you to select an existing point to define the closing location.
  - **Point**: is the name of the existing point at the closing location.

Next: opens the next screen of the adjustment wizard.

Traverse Adjust – Results



*** Preview ***

Adjustment Settings
Angle Adjust
Compass Rule

Angle Adjust

Original	
Error dist.	0.493
Error azm	126°28'02"
Precision	1:6609
Angular error	37°51'05.81"
Change per angle	-4°12'20.65"
Closing angle	261°30'00"
Length	3,255.484
Perimeter	3,255.976
Adjusted	
Error distance	333.416
Error azimuth	62°23'21"
Precision	1:9
Length	3,255.484
Perimeter	3,588.900

Compass Rule

Closing to Known Location	
Location N	5,743.847
Location E	5,066.043
Location Z	230.810
Original	(After Angle Adjust)
Error distance	333.201
Error azimuth	62°18'47"
Precision	1:9
Length	3,255.484
Perimeter	3,588.900
Adjusted	
Error distance	0.000
Error azimuth	---
Precision	Perfect
Length	3,230.649
Perimeter	3,231.142

Point Details

Traverse	18
First point is fixed	
Traverse	12
Original N	5,294.389
Original E	5,439.999
Original Z	246.320
Adjusted N	5,350.777
Adjusted E	5,524.881
Adjusted Z	246.320
Change N	56.388
Change E	84.882
Change Z	0.000
Linear change	101.905
Traverse	11

This screen displays the changes that will be made by the adjustment, where they can be previewed before the actual adjustment is made.

The screen lists the adjustment details in three main sections: the angle adjustment details; the compass rule adjustment details, and the point details where the before-and-after coordinates for each point are listed. An example of the information provided in the Preview screen is shown here.

Error dist: is the horizontal distance between the starting point and closing point.

Error azm: is the direction from the closing point to the starting point.

Precision: is the ratio of the error distance to the length.

Angular error: is the difference between (N-2)·180 and the actual sum of the internal angles, where N is the number of sides in the traverse.

Length: is the sum of all the sides of the boundary.

Perimeter: is the length plus the error distance.

Adjust: if the results in the preview are acceptable tap this button to perform the adjustment.

Miscelaneous Screens

The following screens are only available via a hotkey or a power button (see the User's Manual). They are not available directly from any menu item.

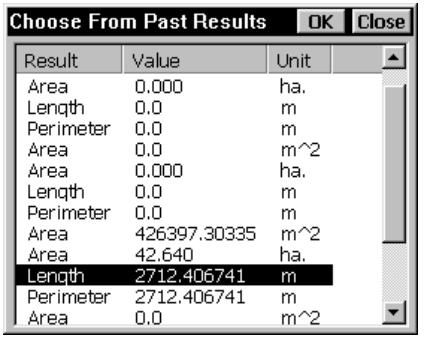
Past Results

Map Display Options

Map View

Past Results

▼, Past Results (where applicable)



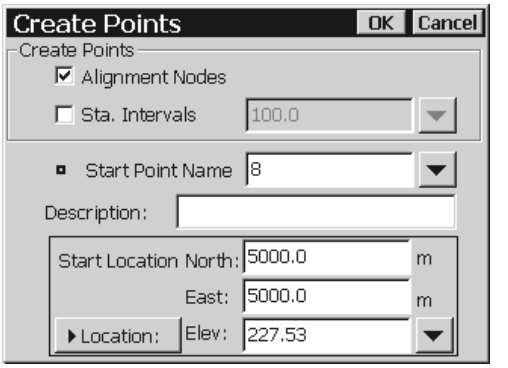
When the Past Results option is used to enter a value in a specific field that was computed previously within Survey Pro.

Select the line that contains the value that you want to use and tap OK. The selected value will then be entered in the field associated with that power button.

Create Points Screen

2 Job | D Edit Alignments | **Create Points**

The Create Points screen is used to store points that coincide with specific locations on an alignment.



Alignment Nodes: when checked, will store points at locations where a change occurs on an alignment, for example where a straight section and a curved section meet.

Sta. Intervals: when checked, will store a point at the specified station interval along an alignment.

Start Point Name: is the name for the first point that will be stored from this screen.

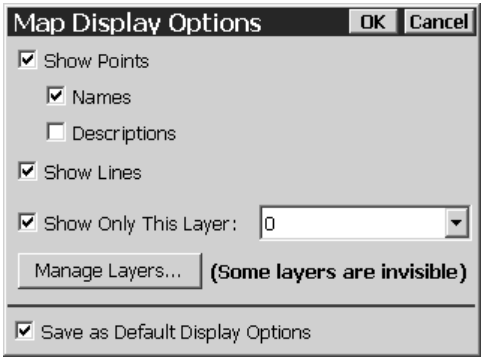
Description: is the description that will be given to all the points that are stored from this screen.

Start Location: is the location for the first point, which is the reference location used to compute the locations of the remaining points. The default location is the POB defined from the Edit Alignment screen.

Map Display Options

Using this will simply toggle the point names and descriptions on and off in some screens, but in other screens it will open the Map Display Options screen, which gives you even more control over what is displayed in the Map View.

The Map Display Options screen is used to configure the information that is displayed in the Map View (described below).



Show Points: will show a dot for each point that is in view.

Names: will show the point name for each point that is in view.

Descriptions: will show the point description for each point in view.

Show Lines: will show all the polylines that are on the DTM layer

Show Only This Layer: when checked, will show only the selected point data that exists on the specified layer. When unchecked, point data from all layers is displayed.

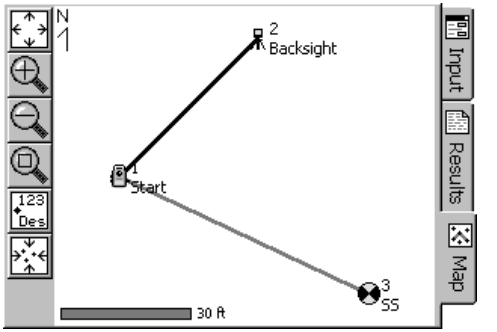
Manage Layers...: opens the Manage Layers screen (Page R-66) where the layers can be configured.

Save as Default Display Options: when checked, will save the selections made to this screen as the default selections.

Map View

Many screens provide access to a map view, which show the points from the current job and other useful information. It can be accessed from the Main Menu with the  button, or any screen that has a  button. Some map views also display a vertical profile.

The bar at the bottom of a map indicates the scale.



Tip: You can pan around your map by dragging your finger or stylus across the screen.

 **Zoom Extents Button**: will change the scale of the screen so that all the points in the current job will fit on the screen.

 **Zoom In Button**: will zoom the current screen in by approximately 25%.

 **Zoom Out Button**: will zoom the current screen out by approximately 25%.

 **Zoom Window Button**: allows you to drag a box across the screen. When your finger or stylus leaves the screen, the map will zoom to the box that was drawn.

 **Increase Vertical Scale**: is only available when viewing a vertical profile. Each time it is tapped, the vertical scale of the view is increased.

 **Decrease Vertical Scale**: is only available when viewing a vertical profile. Each time it is tapped, the vertical scale of the view is decreased.

 **Zoom Preview Button**: will display only the points that are currently in use.

Display / Hide Labels Button: this button will toggle on and off the names and descriptions associated with the points on the screen, or it will access the Map Display Options screen, described above, depending on which screen the button is pressed from.

Appendix A

Transverse Mercator Zones

Central Meridians for State Plane Coordinates

E = East
W = West
C = Central

State	Zone	Central Meridian	State	Zone	Central Meridian
Alabama	E	85 50	Hawaii	1	155 30
	W	87 30		2	156 40
				3	158 00
Alaska	2	142 00		4	159 30
	3	146 00		5	160 10
	4	150 00			
	5	154 00	Idaho	E	112 10
	6	158 00		C	14 00
	7	162 00		W	115 45
	8	166 00			
	9	170 00	Illinois	E	88 20
Arizona	E	110 10		W	90 10
	C	111 55			
	W	113 45	Indiana	E	85 40
				W	87 05
Delaware		75 25			
			Maine	E	68 30
Florida	E	81 00		W	70 10
	W	82 00			
			Michigan	E	83 40
Georgia	E	82 10	(1934)	C	85 45
	W	84 10		W	88 45

State	Zone	Central Meridian	State	Zone	Central Meridian
Mississippi	E	88 50	New Mexico	E	104 20
	W	90 20		C	106 15
				W	107 50
Missouri	E	90 30			
	C	92 30	New York	E	74 20
	W	94 30		C	76 35
				W	107 50
Nevada	E	115 35			
	C	116 40	Vermont		72 30
	W	118 35			
			Wyoming	1	105 10
New Hampshire		71 40		2	107 20
				3	108 45
New Jersey		74 40		4	110 05

Lambert Zones

Central Meridian and Zone Constants for State Plane Coordinates

N = North
S = South
C = Central
NC = North Central
SC = South Central
M = Mainland
I = Island
O = Offshore

State	Zone	Central Meridian	Zone Constant
Arkansas	N	92 00	0.581899
	S	92 00	0.559691
California	1	122 00	0.653884
	2	122 00	0.630468
	3	120 30	0.612232
	4	119 00	0.596587
	5	118 00	0.570012
	6	116 15	0.549518
	7	118 20	0.561243
Colorado	N	105 30	0.646133
	C	105 30	0.630690
	S	105 30	0.613378
Connecticut		72 45	0.663059
Florida	N	84 30	0.502526
Iowa	N	93 30	0.677745
	S	93 30	0.658701
Kansas	N	98 00	0.632715
	S	98 30	0.614528
Kentucky	N	84 15	0.622067
	S	85 45	0.606462
Louisiana	N	92 30	0.528701
	S	91 20	0.500013
	O	91 20	0.454007
Maryland		77 00	0.627634
Massachusetts	M	71 30	0.671729
	I	70 30	0.661095
Michigan	N	87 00	0.722790
	C	84 20	0.706407
	S	84 20	0.680529
Minnesota	N	93 06	0.741220
	C	94 15	0.723388
	S	84 20	0.700928
Montana	N	109 30	0.746452
	C	109 30	0.733354
	S	109 30	0.714901
Nebraska	N	100 00	0.673451
	S	99 30	0.656076

New York (Long Island)		74 00	0.654082
North Carolina		79 00	0.577171
North Dakota	N	100 30	0.744133
	S	100 30	0.729383
Ohio	N	82 30	0.656950
	S	82 30	0.634520
Oklahoma	N	98 00	0.590147
	S	98 00	0.567617
Oregon	N	120 30	0.709186
	S	120 30	0.684147
Pennsylvania	N	77 45	0.661540
	S	77 45	0.648793
South Carolina	N	81 00	0.564497
	S	81 00	0.544652
South Dakota	N	100 00	0.707738
	S	100 20	0.689852
Tennessee		86 00	0.585440
Texas	N	101 30	0.579536
	NC	97 30	0.545394
	C	100 20	0.515059
	SC	99 00	0.489913
	S	98 30	0.454007
Utah	N	111 30	0.659355
	C	111 30	0.640579
	S	111 30	0.612687
Virginia	N	78 30	0.624118
	S	78 30	0.606925
Washington	N	120 50	0.744520
	S	120 30	0.726396
West Virginia	N	79 30	0.637773
	S	81 00	0.618195
Wisconsin	N	90 00	0.721371
	C	90 00	0.705577
	S	90 00	0.687103

Appendix B

TDS Raw Data File Codes

A raw data file is made up of a list of ASCII text records. The entire contents of the raw data file for the current job can be viewed using the View Raw Data screen.

Each record contains data for a complete field operation. A record occupies a single line of text and can consist of multiple fields of data that describe the operation where each field in a record is separated by a comma.

A record begins with a two-letter code followed by a comma to identify the record type. A field begins with a two-letter header followed by a value.

For example, a typical traverse record is shown below:

TR,OP3,FP37,AZ125.3406,ZE87.2617,SD249.87,--FIRE HYDRANT

Meaning:

Type (TR):	Traverse
Occupy point (OP):	3
Foresight point (FP):	37
Azimuth (AZ):	125.3406
Zenith (ZE):	87.2617
Slope Distance (SD):	249.87
Description (--):	FIRE HYDRANT

Records are described in detail on the following pages:

Occupy Record
Record type: OC
Field headers:
PN: Point number
N: Northing (the header is N space)
E : Easting (the header is E space)
EL: Elevation
--: Description

Traverse / Sideshot Record
Record type: TR / SS
Field headers:
OP: Occupy Point
FP: Foresight Point
(one of the following)
AZ: Azimuth
AR: Angle-Right
AL: Angle-Left
(one of the following)
ZE: Zenith
CE: Change Elevation
(one of the following)
SD: Slope Distance
HD: Horizontal Distance
--: Description

Backsight Record
Record type: BK
Field headers:
OP: Occupy point
BP: Back Point
BS: Backsight
BC: Back Circle

Line of Sight Record
Record type: LS
Field headers:
HI: Height of Instrument
HR: Height of Rod

Off Center Shot Record

Record type: OF
Field headers:

- AR: Angle right
- SL: Side slope distance
- DD: Delta Distance
- ZE: Zenith (actual)
- OL: Offset Length

TR/SS Repetition Record

Record type: AA (Accumulating Angle-right)
Field headers:

- BC: Back Circle
- AR: Angle-Right
- ZE: Zenith
- SD: Slope Distance

Record type: RD (Repeat Directional)
Field headers:

- BD: Backsight Direct
- FD: Foresight Direct
- ZD: Zenith Direct
- FV: Foresight Reverse
- ZV: Zenith Reverse
- BV: Backsight Reverse

Record type: MD (Multiple distances)
Field headers:

- SD: Slope distance

Store Point Record

Record type: SP
Field headers:

- PN: Point Number
- N: Northing
- E: Easting
- EL: Elevation
- --: Description

Define a Location Record

Record type: DL

Field Headers:

- PN: point name (POB)
- HD: relative horizontal distance
- VD: relative vertical distance
- AZ: azimuth
- --: Description of the stored point.

Resection Record

Record type: RS

Field Headers:

- PN: Point number
- CR: Circular Reading
- ZE: Zenith (or VA, CE)
- SD: Slope Distance (or HD)

A resection with angles and distance will be recorded as:

RS,PN,CR,ZE,SD
RS,PN,CR,ZE,SD (one reading for each point)

A resection with angles only will be recorded as:

RS,PN,CR
RS,PN,CR
RS,PN,CR (one reading for each point)

Mode Setup Record

The mode setup will be recorded at the beginning of the raw data file and whenever it is changed.

Record type: MO

Field headers:

- AD: Azimuth direction (0 for North, 1 for South)
- UN: Distance unit (0 for Feet, 1 for Meter, 2 for US Survey Feet)
- SF: Scale factor
- EC: Earth Curvature (0 for off, 1 for on)
- EO: EDM offset (inch)
- AU: Angle unit (0 for degree, 1 for grads)

Stake Out Record

Record type: SK

Field headers:

- OP: Occupy Point
- FP: Foresight point
- AR: Angle right
- ZE: Zenith
- SD: Slope distance

Slope Staking Record

Record type: SL

Field headers:

- ST: Station
- OD: Offset direction (0 for center, 1 for right, 2 for left)
- EL: Actual catch point elevation
- GD: Grade (design elevation of the catch point based on the slope line)
- AS: Ahead on station (positive when rod is beyond design station, negative when before station)
- HH: Horizontal distance to hinge point (always positive)
- VH: Vertical distance to hinge point (positive when rod is above hinge)
- HC: Horizontal distance to center line (always positive)
- VC: Vertical distance to center point (positive when rod is above center point)
- CF: Slope used (0 for cut, 1 for fill)
- DS: Design slope
- OB: Observed slope
- --: Note (catch point description)

Slope Staking Reference Offset Record

Record type: SR

Field headers:

- ST: Station
- OD: Actual elevation
- GD: Grade (design elevation, corresponds to the elevation of the found catch point)
- AS: Ahead on station (positive when rod is beyond design station, negative when before station)
- HH: Horizontal distance to hinge point (always positive). This distance includes the reference offset.
- VH: Vertical distance to hinge point (positive when rod is above hinge)
- HC: Horizontal distance to center line (always positive). This distance includes the reference offset.
- VC: Vertical distance to center point (positive when rod is above center point)
- CF: Slope used (0 for cut, 1 for fill)
- DS: Design slope
- OB: Observed slope at the catch point
- OL: Offset length from the catch point
- -- : Note (catch point description)

Cut Sheet Record

Record type: CF (cut or fill)

Field headers:

For an offset stakeout cut sheet

- ST: Station
- OD: Offset direction (0 for center, 1 for right, 2 for left)
- OL: Offset length
- EL: Elevation
- GD: Grade (design)
- --: Description

For a point stakeout cut sheet

- PN: Point number
- EL: Elevation
- GD: Grade
- --: Description

The above record will be recorded only if the stake point is stored. A Side shot (or store point) record will also be recorded.

Sun Shot Record
Record type: SU
Field headers:

For a sun shot setup
- GH: Greenwich hour angle (GHA 0 & GHA 24)
- DE: Declination (DECL 0 & DECL 24)
- SM: Semi-diameter of Sun (in DMS)
- DT: Local date
- TM: Local time

For the actual sun shot
- BD: Backsight Direct
- FD: Foresight Direct
- FV: Foresight Reverse
- BR: Backsight reverse
- LA: Latitude
- LO: Longitude
- EG0: Left trailing edge sun position
- EG1: Right trailing edge sun position
- EG2: Center sun position

Job Record
Record type: JB
Field headers:
- NM: Job name
- DT: Date
- TM: Time

Shoot Benchmark (Remote Elevation) Record
Record type: RE
Field headers:
- OP: Occupied point
- FE: Foresight elevation
- AR: (always 0)
- ZE: Zenith angle
- SD: Slope distance
- --: (always “Remote elev”)

Raw Data Stored by Repetition Shots

When Shooting a Distance to the Backsight
Record Type: RB (repeat backsight)
Field Headers:

- OP: Occupied point
- BP: Backsight point
- AR: Angle right
- ZE: Zenith angle
- SD: Slope distance
- HR: Height or rod **at the backsight**
- --: Description

For Each Foresight Shot
Record Type: RF (repeat foresight)
Field Headers:

- OP: Occupied point
- FP: Foresight point
- AR: Angle right
- ZE: Zenith angle
- SD: Slope distance
- HR: Height or rod **at the foresight**
- --: Description

Raw Data Stored by GPS Operations

Set Base Receiver Position
Record type: BP
Field headers:

- PN : Point Name
- LA: Latitude
- LN: Longitude
- HT: Ellipsoid Height
- SG: Setup Group (default = 0)

Horizontal Control Point
(When solving local transformation, each control point's lat, long and height will be recorded.)

Record type: HC
Field headers:
- PN: Point Name
- LA: Latitude
- LN: Longitude
- HT: Ellipsoid Height
- -- : Description

Vertical Control point
(When solving local transformation, each control point's lat, long and height will be recorded.)

Record type: VC
Field headers:
- PN: control point number
- LA: latitude of control point
- LN: longitude of control point
- HT: ellipsoid height of control point
- --: Description

When solving for direct entered transformation coefficients, the following two records will be stored.

Local transforming coefficients for horizontal
Record type: LH
Field headers:
- PN: Point Name
- Ha: Coefficent a
- Hb: Coefficent b
- Hc: Coefficent c
- Hd : Coefficent d
- SC: Scale
- RT: Rotation

Local transforming coefficients for vertical

Record type: LV
Field headers:

- PN: Point Name
- Va: Coefficent a
- Vb: Coefficent b
- Vc: Coefficent c
- Ba: Base Latitude
- Bo: Base Longitude
- Bh: Base Ellipsoid Height

Geodetic position

(When a point is stored, its geodetic position is recorded.)

Record type: EP
Field headers:

- TM: Time
- LA: Latitude
- LN: Longitued
- HT: Ellipsoid Height
- RH: Horizontal RMS returned from receiver (1 sigma)
- RV: Vertical RMS returned from receiver (1 sigma)
- DH: HDOP if receiver returns this info
- DV: VDOP if receiver returns this info
- GM: GPS Method
- CL: Classification

GPS Store Point

(The GS record is similar to the SP record, which records the coordinate of a point. This record identifies the point is created by GPS.)

Record type: GS
Field headers:

- PN: Point Name
- N: Local Northing
- E: Local Easting
- EL: Local Elevation
- -- : Description

RMS Covariance of GPS Position

Record type: CV

Field headers:

- DC: Derivation
- SV: Minimum number of SV during observation
- SC: Error Scale
- XX: Variance X
- XY: Covariance X,Y
- XZ: Covariance X,Z
- YY: Variance Y
- YZ: Covariance Y,Z
- ZZ: Variance Z

Receiver Setup

Record type: RX

Field headers:

- DC: Derivation Code
- RA: Reduced antenna height (to phase centre)
- RE: Recording interval in seconds
- FI: name of post processing file opened

Equipment Record

Record type: EQ

Field headers:

- DC: Derivation Code
- RX: Rx Type
- RS: Rx Serial Number
- AN: Antenna Number (from Antenna.ini)
- AI: Antenna Index (measure to index from antenna.ini)
- AT: Antenna Type (name of antenna)
- TS: Antenna Serial Number
- TA: Tape Adjustment
- HO: Horizontal Offset
- VO: Vertical Offset

GPS Antenna Height
Record type: AH
Field headers:
- DC: Derivation Code
- MA: Measured antenna height
- ME: Measure Method
- RA: Reduced antenna height (to phase center)

Base Point Geoid Model Elevation
Record type: BG
Field headers:
- PN : Point Name
- HT: Ellipsoid Height
- GU: Geoid Undulation at base
- EL: Elevation of base

GPS Offset Shot Record
Record type: GO
Field headers:
- PN: Point Name
- AZ: Azimuth
- ZE: Zenith Angle
- SD: Slope Distance
- HI : Height of laser at GPS reference point
- HR: Height of laser target at store offset point
- -- : Description

GPS Point Record
Record type: GP
Field headers:
- PN: Point Name
- PT: Point Type

GPS Edit Point Record
Record type: EE
Field headers:
- GF: Geodetic Flags
- SG: Setup Group

Base Line

Record type: BL

Field headers:

DC:	Derivation
PN:	Point Name
DX:	base line Delta X
DY:	base line Delta Y
DZ:	base line Delta Z
-- :	Description (Feature Code)
GM:	Gps Measure Method
CL:	Classification
HP:	Horizontal Precision
VP:	Vertical Precision

Horizontal Mapping Plane Setup

Record type: LM

Field headers:

ME:	Method
CS:	Coordinate System
DA:	Datum
ZO:	Zone
HE:	Hemisphere
FI:	Custom file name (cs5 or pj5)

Vertical Geoid Model Setup

Record type: LG

Field headers:

GI:	Geoid model index

Vertical Ellipsoid Height Setup

Record type: LE

Field headers:

-- :	Description string

Raw Data Stored by Bench Leveling

Bench level, backsight
Record type: BB
Field headers:
- PN: Backsight point
- EL: BS elevation
- ZE: Zenith
- SD: slope distance

Bench level, side shots
Record type: BS
Field headers:
- PN: FS point
- ZE: zenith
- SD: slope distance

Bench level, traverse
Record type: BT
Field headers:
- PN: FS point
- ZE: zenith
- SD: slope distance

Alphabetical listing of Record Types
AA: Accumulating Angle-Right
AH: GPS Antenna Height
BB: Bench Leveling Backsight
BG: Base Point Geoid Model Elevation
BK: Backsight
BL: Base Line
BP: Base Point Record
BS: Bench Leveling Side Shot
BT: Bench Leveling Traverse
CF: Cut Sheet
CV: GPS RMS Covariance
DL: Define a Location
EE: GPS Edit Point Record
EP: GPS Position Record

EQ: Equipment Record
GO: GPS Offset Shot Record
GP: GPS Point Record
GS: GPS Store Point Record
HC: GPS Horizontal Control Point
JB: Open A Job
LE: Vertical Ellipsoid Height Setup
LG: Vertical Geoid Model Setup
LH: Local Transforming Coefficients, Horizontal
LM: Horizontal Mapping Plane Setup
LS: Line Of Sight
LV: Local Transforming Coefficients, Vertical
MD: Multiple Distances
MO: Mode Setup
OC: Occupy
OF: Off Center Shot
RB: Repeat Backsight
RD: Repeat Directional
RE: Remote Elevation
RF: Repeat Foresight
RS: Resection
RX: Receiver Setup
SK: Stakeout A Point
SL: Slope Stake
SP: Store Point
SR: Slope Stake Reference Offset
SS: Side Shot
SU: Sun Shot
TR: Traverse
VC: GPS Vertical Control Point
--: Description Record

Alphabetical listing of Field Headers

AD: Azimuth Direction (0 For North, 1 For South)
AL: Angle-Left
AR: Angle-Right
AT: Attribute Record
AZ: Azimuth
BA: Base Latitude

BB: Bench Level, Backsight
BC: Back Circle
BD: Backsight Direct
Bh: Base Ellipsoid Height
BL: Bench Level, Side Shot
Bo: Base Longitude
BP: Back Point
BR: Bearing (This Field Will Be Recorded As N123.4500W)
BS: Backsight (When Back Point Is Not Defined)
BV: Backsight Reverse
CA: Center Horizontal Angle
CE: Change Elevation
CR: Circular Reading
CV: Covariance
DD: Delta Distance
DE: Declination
DH: Horizontal DOP
DL: Deflection-Left
DR: Deflection-Right
DT: Local Date (MM-DD-YYYY)
DV: Vertical DOP
E : Easting Or East (The Header Is E Space)
EC: Earth Curvature (0 For Off, 1 For On)
EG0: Left Trailing Edge Sun Position
EG1: Right Trailing Edge Sun Position
EG2: Center Sun Position
EL: Elevation
EN: Covariance Easting Northing
EO: EDM Offset
EU: Covariance Easting Upping
FD: Foresight Direct
FE: Foresight Elevation
FL: Solution Flags
FP: Foresight Point
FV: Foresight Reverse
GD: Grade (Design)
GH: Greenwich Hour Angle
Ha: Horizontal localization parameter A
Hb: Horizontal localization parameter B
Hc: Horizontal localization parameter C
HD: Horizontal Distance

Hd: Horizontal localization parameter D
HI: Height Of Instrument
HR: Height Of Rod
HT: Ellipsoid Height
LA: Latitude Of Point
LN: Longitude Of Point
LO: Longitude
N : Northing Or North (The Header is N Space)
NU: Covariance Northing Upping
OC: Occupy Point
OD: Offset Direction (0 For Center, 1 For Right, 2 For
OL: Offset Length
OP: Occupy Point
OS: EDM Offset
PN: Point Number
RH: Horizontal RMS
RV: Vertical RMS
SD: Slope Distance
SE: Sigma E
SF: Scale Factor
SL: Side Slope Distance
SM: Semi-Diameter Of Sun (In Angle)
SN: Sigma N
ST: Station
SU: Sigma U
TM: Time (hh:mm:ss.sssss)
TY: Solution Type
UN: Distance Unit (0 for Feet, 1 for Meter, 2 for US Survey Feet)
VA: Vertical Angle
Va: Vertical Localization Parameter A
Vb: Vertical Localization Parameter B
Vc: Vertical Localization Parameter C
ZD: Zenith Direct
ZE: Zenith Angle
ZV: Zenith Reverse

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